THE UNIVERSITY of ADELAIDE

Undergraduate Courses

2011

Contents

FACULTY OF ENGINEERING, COMPUTER AND MATHEMATICAL SCIENCES

Engineering (Faculty-level Courses)

ENG 2001

Communication and Study Skills

3 units - semester 1 or semester 2

Up to 2.5 hours per week

Restriction: available as a bridging course to approved students only

Available for Non-Award Study

Assessment: Written reports, oral presentations, on-line activities

Topics covered in this course include: reference citation; critical analysis of research publications; writing essays, reports and technical documentation; oral presentation skills; participating in tutorials; formulating questions; exam preparation techniques and familiarisation with assessment procedures.

ENG 2002

Financial Computing II

3 units - semester 1

Up to 5 hours per week

Available for Non-Award Study

Pre-Requisite(s): SACE Stage 2 Mathematical Studies or equivalent

Incompatible: APP MATH 1000, COMP SCI 1012, CHEM ENG 1002, APP MTH 2005 & APP MTH 2106

Assessment: written exam, assignments

This course provides an introduction to basic computer programming concepts and techniques useful for Scientists, Mathematicians and Engineers. The course exposes students to practical applications of computing and commonly used tools within these domains. It introduces techniques for problem solving, program design and algorithm development.

MATLAB (approximately 24 lectures): Basic programming: introduction to the MATLAB environment and the MATLAB help system, data types and scalar variables, arithmetic and mathematical functions, input and output, selection and iteration statements. Functions: user defined functions, function files, passing information to and from functions, function design and program decomposition, recursion. Arrays: vectors, arrays and matrices, array addressing, vector, matrix and element-by-element operations. Graphics: 2-D and 3-D plotting. Mathematical modelling: dynamical systems, linear systems, numerical differentiation and integration.

Spreadsheets (approximately 6 lectures): Spreadsheets as a tool for Scientific Computing: calculation, using in-built functions, plotting and fitting, modelling and optimisation using the Goal-Seek and Solver tools, data analysis.

ENG 3003

Engineering Communication EAL

3 units - semester 1 or semester 2

Up to 3 hours per week

Restriction: International students from NES background who present English language score (IELTS/TOEFL) for admission, or entered via Found.St.Prog or students resident in Australia with admission based on SACE Level 2 LOTE or eligible to take ESL unit in Yr 11/12

Available for Non-Award Study

Incompatible: MATHS 3015 or ENG 3002 or CHEM ENG 1010 & CHEM ENG 2016

Assessment: Online tests, seminar presentation, written assignments

This course provides task-based language development in English as an additional language for spoken and written communication. It is designed to develop English language ability appropriate to the study of Engineering and, at an introductory level, relevant to professional Engineering communication practice. Class work is designed to develop the students' English speaking, listening, writing and reading proficiencies and does so through the use of materials that focus on topical social issues in Engineering professional practice. Tasks and assignments are focused on academic writing, research and the preparation of evidence-based documents, as well as on group discussion and formal seminar presentation

Applied Mathematics

APP MTH 2105

Optimisation and Operations Research

3 units - semester 2

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Incompatible: APP MTH 2008

Assessment: Ongoing assessment 30%, exam 70%

Operations Research (OR) is the application of mathematical techniques and analysis to problem solving in business and industry, in particular to carrying out more efficiently tasks such as scheduling, or optimising the provision of services. OR is an interdisciplinary topic drawing from mathematical modelling, optimisation theory, game theory, decision analysis, statistics, and simulation to help make decisions in complex situations. This first course in OR concentrates on mathematical modelling and optimisation: for example maximising production capacity, or minimising risk. It focuses on linear optimisation problems involving both continuous, and integer variables. The course covers a variety of mathematical techniques for linear optimisation, and the theory behind them. It will also explore the role of heuristics in such problems. Examples will be presented from important application areas, such as the emergency services, telecommunications, transportation, and manufacturing. Students will undertake a team project based on an actual Adelaide problem.

Topics covered are: formulating a linear program; the Simplex Method; duality and Complementary slackness; sensitivity analysis; an interior point method; alternative means to solve some linear and integer programs, such as primal-dual approaches methods from a complete solution (such as Greedy Methods, and Simulated Annealing), methods from a partial solution (such as Dijkstra's shortest path algorithm, and branch-and-bound).

APP MTH 3000

Computational Mathematics III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: MATHS 2102 or 2201 & MATHS 2104 or an equivalent knowledge of numerical methods. Ability to write simple Matlab computer programs.

Assessment: Ongoing assessment 30%, final exam 70%

In exploring large scale, complex systems, physicists, engineers, financiers and mathematicians often formulate problems as partial differential equations or many coupled ordinary differential equations. Only rarely can these mathematical models be solved algebraically. Instead computational mathematics derives approximate models that form the basis of computer predictions. Such models predict the climate, the weather, option prices, industrial processes, engineering devices, blood flow, epidemiology and more. This course develops sound stable computational methods for exploring large-scale systems.

Topics covered are: the numerical solution and stability of ordinary differential equations, using explicit and implicit methods; finite-difference and spectral methods applied to boundary value problems and certain partial differential equations, including Laplace's equation, the heat equation and the wave equation; stability analysis of these schemes; methods used to solve large systems of linear equations such as those that arise from finite-difference schemes; continuation methods.

APP MTH 3001

Applied Probability III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: Markov Chains as taught in APP MTH 2008 or MATHS 2103

Assessment: Ongoing assessment 30%, final exam 70%

Many processes in the real world involve some random variation superimposed on a deterministic structure. Often -- as in games -- the random component is the dominant part. This course aims to provide a basic toolkit for modelling and analyzing discrete-time problems in which there is a significant probabilistic component.

Markov chain examples in the course include population branching processes (with application to genetics), random walks (with application to tennis and other games), and processes with an over--riding cost structure.

Topics covered are: hitting probabilities and hitting time theorems, (including extremal versions), population branching processes, inhomogeneous random walks on the line, transient, recurrent and ephemeral states, communicating classes, solidarity properties, necessary and sufficient conditions for transience and positive recurrence, global balance, partial balance, reversibility, rewards on Markov chains, and the policy improvement algorithm.

APP MTH 3002

Fluid Mechanics III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: APP MTH 2000 or APP MTH 2007 or APP MTH 2010 or MATHS 2201 or 2102, APP MTH 2002 or 2006 or MATHS 2202 or MATHS 2101

Assessment: ongoing assessment 30%, final exam 70%

Fluid flows are important in many scientific and technological problems including atmospheric and oceanic circulation, energy production by chemical or nuclear combustion in engines and stars, energy utilisation in vehicles, buildings and industrial processes, and biological processes such as the flow of blood.

Considerable progress has been made in the mathematical modelling of fluid flows and this has greatly improved our understanding of these problems, but there is still much to discover. This course introduces students to the mathematical description of fluid flows and the solution of some important flow problems.

Topics covered are: the mathematical description of fluid flow in terms of Lagrangian and Eulerian coordinates; the derivation of the Euler, Navier-Stokes and Bernoulli equations from the fundamental physical principles of mass and momentum conservation; use of the stream function, velocity potential and complex potential are introduced to find solutions of the governing equations for inviscid, irrotational flow past bodies and the forces acting on those bodies; solutions of the Navier-Stokes equations for simple viscous flows.

APP MTH 3004

Mathematical Biology III

3 units - not offered in 2011

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: APP MTH 2000 or APP MTH 2007 or APP MTH 2010 or MATHS 2201 or MATHS 2102

Assessment: Ongoing assessment 30%, final exam 70%

The application of mathematics to problems arising in the life sciences is a rapidly growing area yielding quantitative understanding of questions about such things as the spread of infectious diseases, population growth and interaction, organ (e.g. heart) function, cell signalling, nutrient supply, and more. This course will introduce students to the fascinating world of modelling biological systems. A variety of biological problems will be considered, in the context of which students will be exposed to a variety of mathematical techniques. No previous exposure to biology is necessary.

Topics covered are: Scalar, discrete-time models, analysed using the mathematical tools of cobwebbing and linear stability analysis of fixed points; Linear stability analysis of systems of discrete-time equations; The theory of dynamical systems for models comprised of linear and nonlinear scalar and coupled ordinary differential equations, including vector fields, phase-plane analysis and elementary bifurcation theory; Reaction-advection-diffusion models, including equation derivation from the law of mass conservation and Fick's law. The 1D Fisher equation is examined in particular, a Hamiltonian function is introduced for analysis of the steady equation, while travelling wave solutions of the unsteady equation are obtained.

APP MTH 3012

Financial Modelling: Tools and Techniques

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1011

Assumed Knowledge: Familiarity with Excel spreadsheets

Incompatible: APP MTH 3011

Assessment: Ongoing assessment 30%, final exam 70%

The growth of the range of financial products that are traded on financial markets or are available at other financial institutions, is a notable feature of the finance industry. A major factor contributing to this growth has been the development of sophisticated methods to price these products. The significance to the finance industry of developing a method for pricing options (financial derivatives) was recognized by the awarding of the Nobel Prize in Economics to Myron Scholes and Robert Merton in 1997. The mathematics upon which their method is built is stochastic calculus in continuous time. Binomial lattice type models provide another approach for pricing options. These models are formulated in discrete time and the

examination of their structure and application in various financial settings takes place in a mathematical context that is less technically demanding than when time is continuous. This course discusses the binomial framework, shows how discrete-time models currently used in the financial industry are formulated within this framework and uses the models to compute prices and construct hedges to manage financial risk. Spreadsheets are used to facilitate computations where appropriate.

Topics covered are: The no-arbitrage assumption for financial markets; no-arbitrage inequalities; formulation of the one-step binomial model; basic pricing formula; the Cox-Ross-Rubinstein (CRR) model; application to European style options, exchange rates and interest rates; formulation of the n-step binomial model; backward induction formula; forward induction formula; n-step CRR model; relationship to Black-Scholes; forward and future contracts; exotic options; path dependent options; implied volatility trees; implied binomial trees; interest rate models; hedging; real options; implementing the models using EXCEL spreadsheets.

APP MTH 3013

Differential Equations III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: APP MTH 2000 or APP MTH 2007 or APP MTH 2010 or MATHS 2201 or MATHS 2102

Assessment: Ongoing assessment 30%, final exam 70%

Differential equations describe a wide range of practical problems in areas such as biology, engineering, physical sciences, economics and finance. This course aims to provide students with techniques required to solve classes of ordinary and partial differential equations that commonly occur in applications.

Topics covered are: methods for the solution of systems of linear and non-linear ordinary differential equations; techniques for the solution of two point boundary value problems for second order linear ordinary differential equations with variable coefficients; classification of partial differential equations and the solution of boundary value problems for these equations using the methods of reduction to ordinary differential equations by use of separation of variables, integral transforms, and characteristics.

APP MTH 3014

Optimisation III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: Linear programming as taught in APP MATH 2008 or APP MATH 2105

Assessment: Ongoing assessment 30%, final exam 70%

Most problems in life are optimisation problems: what is the best design for a racing kayak, how do you get the best return on your investments, what is the best use of your time in swot vac, what is the shortest route across town for an emergency vehicle, what are the optimal release rates from a dam for environmental flows in a river? Mathematical formulations of such optimisation problems might contain one or many independent variables. There may or may not be constraints on those variables. There is always, though, an objective: minimise or maximise some function of the variable(s), subject to the constraints. This course will examine nonlinear mathematical formulations, and will concentrate on convex optimisation problems. Many modern optimisation methods in areas such as design of communication networks, finance, etc, rely on the classical underpinnings covered in this course.

Topics covered are: One-dimensional (line) searches: direct methods, polynomial approximation, methods for differentiable functions; Theory of convex and nonconvex functions relevant to optimisation; Multivariable unconstrained optimisation, in particular, higher-order Newton's Method, steepest descent methods, conjugate direction and conjugate gradient methods; Constrained optimisation, including Kuhn-Tucker conditions and the Gradient Projection Method; Penalty methods.

APP MTH 3016

Random Processes III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: Knowledge of Markov chains, such as would be obtained from MATHS 2103

Assessment: Ongoing assessment 30%, final exam 70%

This course introduces students to the fundamental concepts of random processes, particularly continuous-time Markov chains, and related structures. These are the essential building blocks of any random system, be it a telecommunications network, a hospital waiting list or a transport system. They also arise in many other environments, where you wish to capture the development of some element of random behaviour over time, such as the state of the surrounding environment.

Topics covered are: Continuous-time Markov-chains: definition and basic properties, transient behaviour, the stationary distribution, hitting probabilities and expected hitting times, reversibility; Basic Queueing Theory: arrival processes, service time distributions, Little's Law; Point Processes: Poisson process, properties and generalisations; Renewal Processes: preliminaries, renewal function, renewal theory and applications, stationary and delayed renewal processes; Queueing Networks: Kendall's notation, Jackson networks, mean value analysis; Loss Networks: truncated reversible processes, circuit-switched networks, reduced load approximations.

APP MTH 3017

Waves III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: APP MTH 2000, APP MTH 2007, APP MTH 2010, MATHS 2201 or MATHS 2102

Assessment: Ongoing assessment 30%, final exam 70%

Waves impact on every facet of our experience. The simple acts of seeing and hearing rely on electromagnetic and sound waves. Traffic flows in waves. Earthquakes and tsunamis are waves capable of causing enormous devastation. Waves carry the information required for our technological society to function. This course will introduce you to the study of waves through a wide variety of examples of wave motions.

Topics covered are: waves on stretched strings and membranes, sound waves, water waves, electromagnetic waves, waves in elastic media, traffic waves and solitary waves. The course will emphasise the mathematical features common to many of these phenomena, such as the transmission and reflection of waves at interfaces, cut-off frequencies, dispersion and group velocity, internal reflection and evanescent waves, shock waves and solitons.

APP MTH 3019

Mathematics of Nanotechnology III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: MATHS 2201 or 2102 & MATHS 2101or 2202

Assessment: Ongoing assessment 30%, final exam 70%

Nanoscience is a new multidisciplinary field at the nexus of physics, chemistry and engineering. Materials and systems that may be very well understood at the macroscale can often exhibit surprising phenomena at the nanoscale. This course will introduce you to the mathematical descriptions of some of these phenomena and the processes and techniques of developing models in this emergent field

Topics covered are: the basic geometry of nanostructures; the continuum approach to calculating the intermolecular interaction potential utilizing special functions (such as gamma, beta, hypergeometric and generalized hypergeometric functions of two variables); applying the continuum approach to nested nanostructures and nano-oscillators; a least squares approach to modelling the joining of nanostructures; a calculus of variations approach to modelling the joins between nanostructures; the polyhedral model for carbon nanotubes and related structures.

APP MTH 3020

Stochastic Decision Theory III

3 units - semester 2

Up to 3 hours per week

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: Knowledge of linear programming, such as would be obtained from APP MTH 2105 and of Markov chains, such as would be obtained from MATHS 2103

Assessment: Ongoing assessment 30%, final exam 70%

People make decisions everyday: whether to take an umbrella to work; to take an available park for their car of continue to search for a better one; which of several possible methods to implement to attempt to save a species from extinction; and, which people in the population to give a vaccine to. All of these decisions are being made under uncertainty: there exists a certain chance of rain today; a certain chance all of the car parks are used; uncertainty about how many individuals of the species exist and how they will respond to each of the possible interventions; and, the actual dynamics of the infection and the uptake of the vaccine by the population. This course will focus on formulating problems of this type in a mathematical framework and provide methods for making the best decision possible taking into account the uncertainty.

Topics covered are: stochastic linear programming - the extension of linear programming to account for uncertainty; Markov decision processes (MDP) and dynamic programming - the framework for solving problems in which the state of the process up to the time of decision is known but the behaviour of the process is governed by a Markov chain; Hidden Markov models, and Partially-observable MDPs - the extension of MDPs where we can only observe a `noisy' version of the state of the system.

APP MTH 4015A/B

Honours Applied Mathematics Part 1 & 2

24 units - full year

Restriction: Available only to students admitted to the relevant Honours program

Pre-Requisite(s): At least 12 units of Mathematical Sciences courses at credit standard or above, of which at least 9 units must be from the Discipline - different backgrounds may be accepted at the discretion of the Head of School

Assessment: exams for each course at end of semester in which it is offered, project, seminar

Students are required to obtain the approval of the Head of Mathematical Sciences before enrolling in the program, and should preferably consult with the Head before enrolling for Level III. Candidates may apply to the Head for permission, under certain circumstances, to take Honours over two years.

Students select from lecture courses offered by the School of Mathematical Sciences and other Schools as may be agreed to by Head of Mathematical Sciences. Students may be allowed to take appropriate Level III Mathematical Sciences courses not already taken.

Students are assigned a supervisor to advise on and approve their lecture program and give guidance in writing a project on an Applied Mathematics topic. Possible topics should be discussed with staff during the preceding year.

APP MTH 4017A/B

Honours Applied Maths & Statistics Part 1 & 2

24 units - full year

Restriction: Available only to students admitted to the relevant Honours program

Available for Non-Award Study

Pre-Requisite(s): At least 6 units of Level III in each of the two Disciplines at credit standard or above - different backgrounds may be accepted at the discretion of the Head of School

Assessment: exams for each course at end of semester in which it is offered, project, seminar

Candidates are required to undertake at least 2 Honours level Computer Science options and at least 2 Honours level Applied Mathematics options totalling at least 15 units. Other lecture topics may be included at the discretion of the Heads of both Schools. They must also complete a project supervised within the Applied Mathematics discipline in a topic with a significant computing component. Candidates are required to present a project that will involve interdisciplinary work at the interface of Statistics and Applied Mathematics.

The student's project will be jointly supervised by staff of both the Statistics and the Applied Mathematics disciplines.

APP MTH 4050

System Modelling and Simulation

3 units - semester 1

Up to 2.5 hours per week

Restriction: may only be presented towards some Engineering Programs

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: 6 units of Level II Applied Mathematics courses

Assessment: ongoing assessment 30%, exam 70%

The course provides students with the skills to analyse and design systems using modelling and simulation techniques. Case studies

will be undertaken involving hands-on use of simulation packages. The application of simulation in areas such as manufacturing, telecommunications and transport will be investigated. At the end of this course, students will be capable of identifying practical situations where simulation modelling can be helpful, reporting to management on how they would undertake such a project, collecting relevant data, building and validating a model, analysing the output and reporting their findings to management. Students complete a project in groups of two or three, write a concise summary of what they have done and report their findings to the class. The project report at the end of this course should be a substantial document that is a record of a student's practical ability in simulation modelling, which can also become part of a portfolio or CV.

Topics covered are: Introduction to simulation, hand simulation, introduction to a simulation package, review of basic probability theory, introduction to random number generation, generation of random variates, analysis of simulation output, variance reduction techniques and basic analytic queueing models

APP MTH 4051

Applied Mathematics Topic E

3 units - semester 2

Up to 2.5 hours per week

Restriction: may only be presented towards some Engineering Programs

Available for Non-Award Study

Assessment: 30% ongoing assessment, 70% exam

Please contact the School of Mathematical Sciences for further details or view the course information tab on the School of Mathematical Sciences web site at http://www.maths.adelaide.edu.au/courses/

APP MTH 4052

Applied Mathematics Topic F

3 units - semester 2

Up to 2.5 hours per week

Restriction: may only be presented towards some Engineering Programs

Available for Non-Award Study

Assessment: 30% ongoing assessment, 70% exam

Please contact the School of Mathematical Sciences for further details or view the course information tab on the School of Mathematical Sciences web site at:

http://www.maths.adelaide.edu.au/courses/

Chemical Engineering

CHEM ENG 1004

Introduction to Bio-Processing

3 units - semester 1

Up to 5 hours per week

Available for Non-Award Study

Pre-Requisite(s): SACE Stage 2 Maths Studies, SACE Stage 2 Chemistry

Assumed Knowledge: SACE Stage 2 Specialist Maths, SACE Stage 2 Physics

Assessment: written exam, performance in tutorial classes & class assignments - complete details at commencement of course

Introductory computing and programming; the elements of databases; elementary concepts and tools used in bioinformatics. Simple process engineering concepts are introduced and their application in society, industry and the environment will be illustrated. Basic measurement and conservation principles for mass and energy are applied to solve simple problems e.g. in food processing, biotechnology, fuel combustion and energy generation, fluid flow and waste treatment.

CHEM ENG 1006

Introduction to Pharmaceutical Engineering

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Pharmaceutical) students only

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Mathematical Studies

Assessment: written exams, performance in tutorial classes; class assignments & projects - full details advised at beginning of course

An introductory subject with emphasis on integrating the molecular and cellular biosciences with the quantitative, systems-oriented engineering analysis and synthesis approach

Topics include history of pharmaceuticals; introduction to the pharmaceuticals industry and its various sectors; engineering stages required for manufacture of active ingredients (primary manufacture) and its dosage forms (secondary manufacture) overview of economics (e,g bugs to $s); overlap of molecular sciences with traditional engineering disciplines; need for interdisciplinary work; particular case studies or examples (e,g. drug delivery systems, bioactive molecules from GMOs, etc).

CHEM ENG 1007

Process Engineering I

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Math.Studies, Specialist Maths, Physics

Assessment: Final exam, tests, quizzes, assignments

To provide students with the basic principles and knowledge which define chemical and process engineering, and to demonstrate these through basic calculations and problem solving. Students are introduced to topics and theory related to the core tasks that chemical process engineers undertake. The four main areas of chemical engineering are introduced: conservation principles, fluid mechanics, transfer processes and reaction engineering.

CHEM ENG 1008

Engineering Computing

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Math. Studies, Specialist Maths, Physics

Assessment: projects, exam

The course will be focused on the use of computing in engineering application. The course consists of four parts, these are: Introduction to Engineering modeling techniques, advanced Spreadsheet for engineering calculations, introduction to the ANSI "C" computing language, and introduction to engineering computing using MATLAB.

CHEM ENG 1008NT

Engineering Computing

3 units - semester 2

45 hrs lectures and practicals

Assumed Knowledge: SACE Stage 2 Maths Studies, Specialist Maths, Physics

Assessment: projects, exam

The course will be focused on the use of computing in engineering application. The course consists of four parts, these are: Introduction to Engineering modeling techniques, advanced Spreadsheet for engineering calculations, introduction to the ANSI "C" computing language, and introduction to engineering computing using MATLAB.

CHEM ENG 1009

Materials I

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies, SACE Stage 2 Specialist Maths, SACE Stage 2 Physics

Assessment: Final exam, test, quizzes, assignments

To provide students with a basic understanding of the underlying science and the engineering performance of materials used in engineering applications. Topics covered include: atomic structure, imperfections in solids, diffusion in solids, mechanical properties of metals, dislocations and strengthening mechanisms, failure mechanisms, phase diagrams and phase transformations in metals, structures and properties of ceramics/polymers/composites, applications and processing of ceramics/polymers, corrosion and degradation of materials.

CHEM ENG 1010

Professional Practice I

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assessment: 25% exam, 40% design project, 35% individual and group assessments

The discipline of chemical engineering has a long history and an exciting future. Since its formation in the late-1800s, the discipline has grown and evolved from its early roots in the production of bulk chemicals, through the petrochemical age, until today where chemical engineers are at the forefront of industries such as biotechnology, pharmaceutical, advanced materials, nanotechnology, food & beverage, and many more. Chemical engineers' work in an array of industries and various contexts includes communication with colleagues, managers, clients, representatives from professional organisations, allied industries and government departments. As an effective communicator and decision maker, you will need to be able to present your interpretation and findings on a range of issues, as will occur in the negotiation and management of projects, the submission of tenders, and the advising of clients. This course is an introduction for new students of chemical engineering and related programs to their new discipline and to their new learning environment. This introduction is made through a mix of lectures, group-based activities, site visits, and presentations from practising chemical engineers. Since a key attribute of successful professional engineers is the ability to communicate effectively, the course focuses on improving core engineering communication skills, while also accommodating students entering the course with different standards of communication skills.

CHEM ENG 2010

Introduction to Process Simulation

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Chemical), BE(Pharmaceutical), BE(Sustainable Energy (Chemical) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1007 & MATHS 1012

Assessment: assignments, Final exam

To introduce students to the principles of material and energy balances and the techniques used in chemical process calculations; To develop systematic problem solving skills so as to be able to deal with the complexity of large problems; To provide basic instruction in application of knowledge learned to industrial process design.

CHEM ENG 2011

Chemical Engineering Thermodynamics

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MATHS 1012, CHEM ENG 1008, CHEM ENG 1007, CHEM 1200, CHEM 2510, CHEM 2512, CHEM 2514 & CHEM 2516

Assessment: Exam 70%, Tutorials and tests 30%

To provide students with the fundamental concepts and principles of modern chemical and pharmaceutical engineering thermodynamics with an emphasis on relevance to other parts of the chemical and pharmaceutical engineering curriculum. The application of these principles to the solution of energy flow and equilibrium problems will be emphasised.

CHEM ENG 2012

Principles of Pharmaceutical Engineering

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Pharmaceutical) & associated double degree students only

Available for Non-Award Study

Pre-Requisite(s): CHEM ENG 1006

Assumed Knowledge: CHEM ENG 1007

Assessment: Exams and assignments

This course provides an overview of the pharmaceutical industry, including basic information about drug discovery and development, FDA requirements and approval processes, and the role of key operational units in drug manufacturing processes. The principles for separation operations to recover products from biological processes & natural resources will be covered, including recombinant DNA technology, cell growth, kinetics, cell disruption, centrifugation, membrane filtration, chromatography. Brief introduction to process design emphasizing unique requirements of pharmaceutical plants (e.g. high purity, specialized utility systems, etc.) will be included.

CHEM ENG 2013

Process Modelling and Computations

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1007 & CHEM ENG 1008

Problem solving in Chemical & Biochemical Engineering, introduction to commonly used software package- Polymath, simple chemical process models - heat exchange, flash systems, CSTRs (tank CSTRs, Thermodynamic models, heat exchange, mass transfer, phase equilibria, biochemical engineering, design & preliminary economic analysis.

CHEM ENG 2014

Process Engineering IIA

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MATHS 1012

Assessment: Exam 70%, Tutorials 30%

The objective of the course is to introduce students to the basic concepts of heat and mass transfer encountered in chemical process industries. At the conclusion of the course, students should be able to: Understand the basic concepts and laws of the three modes of heat transfer; Apply analytical techniques in conduction heat-transfer problems; Understand and use empirical equations to solve forced and natural convection heat-transfer problems; Solve simple radiation heat transfer problems; Analyse the heat transfer processes involved in boiling and condensation; Perform basic calculations of common heat exchangers to determine relevant design parameters; Solve simple diffusion mass transfer problems; Understand the workings of relevant instrumentation

CHEM ENG 2015

Principles of Biotechnology II

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM 1000A/B, GENETICS 1000A/B

Assessment: Final exam, lectures, projects, tutorials

This multi-disciplinary course provides students with an introduction to key aspects of modern biotechnology practice including the interaction between scientific discovery and practical production tools and aspects. Four key areas will be covered: Introduction to Bio-Process Engineering Principles - enzymes, cell-culture systems, fermenters, recovery and purification of product. Microbial Gene Expression - sequencing and amplification of DNA, gene expression in prokaryotic and eukaryotic systems, molecular diagnostics, therapeutic agents, vaccines and commercial processes. Plant Systems - DNA marker technology, plant culture, genetic engineering and geonomics. Mammalian Systems - characteristics and growth, gene transfer in vitro & in vitro, expression systems, applications.

CHEM ENG 2016

Professional Practice II

3 units - semester 2

Up to 2 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1010 & CHEM ENG 1007

Assessment: 65% laboratory report and presentation, 20% case study, 15% individual and group assessments

Excellent practical skills and the ability to communicate effectively to a wide range of audiences are amongst the most important attributes of professional engineers. In this course students will undertake a series of workshops and laboratory sessions to enhance and develop these important skills with an emphasis on the professional practice of chemical engineering (e.g. career planning and equity and diversity) and on laboratory projects dealing with the study of fluid mechanics

CHEM ENG 2017

Transport Processes in the Environment

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assessment: Final Exam 70%, Tutorials 30%

The objective of this course is to illustrate the application of certain key principles of engineering and science that are required for any quantitative treatment of environmental problems. Topics to be covered in this course include: Introduction and basic concepts; Simple kinetic models, Environmental chemicals and properties; Inter-media transport; Simple exchange models; Air pollution problems; Water chemistry, Environmental modeling; Plume dispersion; Greenhouse effect; Ozone depletion; Nuclear chemistry; Radiation and Uranium mining.

CHEM ENG 2018

Process Engineering IIB

3 units - semester 2

Up to 3.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MATHS 1012, CHEM ENG 1000

Lectures and tutorials focused on the statics and dynamics of fluids. Substantial emphasis is placed on analysis and solutions of fluid flow problems frequently encountered in the process industries.

CHEM ENG 2019

Introduction to Minerals Processing

3 units - semester 2

Up to 4 hours per week

Assessment: examination 70%, tutorials/assignments 30%

The application of process principles to minerals processing operations including flotation, size reduction, gravity separation, hydrometallurgy, pyrometallurgy and electrometallurgy

CHEM ENG 3007WT

Winery Engineering III

3 units - semester 1

Up to 6 hours per week

Available for Non-Award Study

Assumed Knowledge: AGRONOMY 2012RW or CHEM ENG 1001 or equivalent

Assessment: final exam, tutorials, project work

Application of engineering principles and practices to winemaking. Process calculations (mass and energy balances), process utilities (refrigeration, process heating and cooling), steam systems, electrical power systems, heat transfer and heat exchangers, must, juice and wine transfer methods, centrifugation and filtration, process control and instrumentation.

CHEM ENG 3021

Advanced Pharmaceutical Unit Operation

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Pharmaceutical) students only

Assumed Knowledge: CHEM ENG 2005, CHEM ENG 2009

Assessment: Exam and assignments

This course examines methodologies, both applied and fundamental, to analyze and scale up manufacturing pharmaceutical processes involving crystallization, adsorption, moving bed processes, electrophoresis, liquid and dispersed-phase systems e.g. liquid and multiphase mixing, sterilization and sanitation, lyophilisation. Also processes involving solids processing, such as solids characterization, blending, milling, granulation, tableting, coating, etc.

CHEM ENG 3022

Pharmaceutical Engineering Applications A

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 2018

Assessment: Exams 70%, Tutorials 30%

Description of particulate systems. Multiphase systems; fundamentals and application to design and analysis of physical separation and transport processes

CHEM ENG 3023

Chemical Engineering Unit Operations Laboratory

3 units - semester 2

Up to 4.5 hours per week

Co-Requisite(s): CHEM ENG 3031, CHEM ENG 3033

Assumed Knowledge: CHEM ENG 3035, CHEM ENG 3034, CHEM ENG 2014, CHEM ENG 2018

Assessment: Project reports

A laboratory program illustrating the principles of transport theory, fluid mechanics, unit operations, process dynamics and control, and kinetics and reactor design.

CHEM ENG 3024

Professional Practice III

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assessment: 60% exam, 40% continuous assessment

The professional practice of chemical engineering, and related disciplines, relies on a broad range of discipline-specific and transferable professional skills. In this course, key aspects of the professional practice of chemical engineering are studied. These aspects include the fundamental elements of process economics, process safety, sustainability, ethics and the responsibilities of professional engineers, project management, risk analysis and decision-making. In this course students will undertake a series of workshops, lectures, projects and case studies.

CHEM ENG 3025

Pharmaceutical Plant Design & Process Engineering

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: CHEM ENG 2010

Assessment: Final examination (50%), Major design project (50%)

The course contents includes:

Economic analysis of process designs; Introduction to process design; Introduction to computer simulation packages; Design of major process components using a computer simulation package; Major process design project.

CHEM ENG 3026

Pharm Eng Projects & Experimental Design III

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: CHEM ENG 3022, CHEM ENG 3027, CHEM ENG 3024

Assessment: Project reports

Advanced laboratory practice, data analysis and technical communications are the focus of this course. As a component of this course, experimental design which deals with the design and analysis of experiments with respect to the pharmaceutical process will be included. A laboratory program to pharmaceutical engineering students to illustrate the principles and phenomena encountered in pharmaceutical engineering

CHEM ENG 3027

Pharmaceutical Engineering Applications B

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM 2510 or CHEM 2530

Incompatible: CHEM 3017

Assessment: Examination 70%; Assignments 30%

The theory of simple and complex chemical kinetic systems and their application to the design of commercial-scale reactors

CHEM ENG 3029

Materials III

3 units - semester 2

Up to 4 hours per week

Incompatible: CHEM ENG 1009, CHEM ENG 3001

Assessment: Final examination/assignments

Mechanical and rheological properties of materials. Role of dislocations and imperfections. Case studies in phase transformations. Polymers and composites. Fracture behaviour of materials. Merit indices and materials selection. Electrochemical engineering including corrosion and corrosion prevention, electroplating, electro-machining, fuel cells, energy storage and electrochemical synthesis. High temperature oxidation.

CHEM ENG 3030

Simulation and Concept Design

3 units - semester 2

Up to 4 hours per week

Pre-Requisite(s): CHEM ENG 2010

Incompatible: CHEM ENG 3014

The course contents are:

Economic analysis of process designs; Introduction to process design; Introduction to computer simulation packages; Design of major process components using a computer simulation package; Major process design project

CHEM ENG 3031

Process Control & Utilities

3 units - semester 2

Up to 4 hours per week

Incompatible: CHEM ENG 3015

Assessment: 70% Final Examination, 30% Projects & Tutorials

Introduction to key elements of feedback control, development of models, analysis of first and second-order systems, effect of dead time, PID controllers, stability & stability criteria, controller tuning and model fitting. Instrumentation: commonly used primary sensing elements, signal transmission for analog & digital systems, final control elements. Introduction to plant utility systems. The major components and typical layouts of three-phase and single-phase electricity supply systems; The performance of transformers and major electric motor types. Principles of motor selection; Economic aspects of electric power supply including power factor correction

CHEM ENG 3033

Chemical Engineering Applications C

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: CHEM ENG 2010

Assessment: Examination 70%; Tutorials 30%

Stage-wise and continuous contact processes; single and multi-stage operation; use of reflux; analysis and design. Processes considered include: liquid-liquid extractions, leaching, stripping, gas absorption, and distillation

CHEM ENG 3034

Chem Eng Application B

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: MATHS 2201 & CHEM 2510 or CHEM 2530

Incompatible: CHEM 3017

Assessment: Examination 70%; Assignments 30%

The theory of simple and complex chemical kinetic systems and their application to the design of commercial-scale reactors

CHEM ENG 3035

Chem Eng Application A

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: CHEM ENG 2018

Incompatible: CHEM ENG 3018

Assessment: Examination 70%; Tutorials 30%

Description of particulate systems. Multiphase systems; fundamentals and application to design and analysis of physical separation and transport processes

CHEM ENG 4014

Plant Design Project

6 units - semester 2

Up to 15.5 hours per week

Restriction: Available to BE(Pharmaceutical) & BEChemical students only

Available for Non-Award Study

Co-Requisite(s): CHEM ENG 4010

Assumed Knowledge: CHEM ENG 3032

Assessment: assignments, exam

Project: the project involves the economic comparison of alternative processes for the manufacture of a nominated chemical or biological product, the study of a selected process, calculation of material and energy balances, preparation of flow sheets, design of selected plant items, an assessment of factors affecting plant safety and environmental impact, estimation of plant cost and process economics, preparation of a design report and drawing of plant lay-out.

CHEM ENG 4032

Composite & Multiphase Polymers

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1003 or CHEM ENG 1009

Assessment: Exams, tutorials, project

This course aims to provide students with a basic understanding of the underlying science and the engineering performance of composites (part A) and multiphase polymer (part B) materials, which form an important class of engineering materials. Topics covered in part A include: composite benefits and applications; types of fibres and polymer matrices; fibre architecture; manufacturing processes; elasticity and stress analysis; strength, modulus and Poisson's ratio of unidirectional composites; short fibre composites; lamination theory; toughness of composites; characterisation of composites and their performance. Topics covered in part B include: thermodynamics of blending; properties of polymer blends and foaned polymer; production and properties of structural foams; and orientated polymers.

CHEM ENG 4033

Pharm Eng Research Project (H)

3 units - semester 2

150 hrs investigations and seminars

Assessment: project reports, seminar assessment

Candidates are required to complete satisfactorily an open-ended project and submit a written report on a topic supplied by the School and present a seminar/poster at the end of the semester summarising results

CHEM ENG 4034

Professional Practice IV

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 3024

Assessment: 50% exam, 50% continuous assessment

The professional practice of chemical engineering, and related disciplines, relies on a broad range of discipline-specific and transferable professional skills. In this course, advanced topics in the professional practice of chemical engineering are studied. These elements relate to an understanding of the business environment facing professional engineers and include advanced project management, the management of human and physical resources, optimization, decision-making and an introduction to business management strategies such as "Six Sigma" or "Lean Manufacturing". Advanced topics in process safety and sustainability are also included. In this course students will undertake a series of workshops, lectures, projects and case studies.

CHEM ENG 4035

Pharmaceutical Plant Design Project

6 units - semester 2

Up to 15.5 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 3025

Assessment: Assignments, examinations

Project: the project involves the economic comparison of alternative processes for the manufacture of a nominated chemical or biological product, the study of a selected process, calculation of material and energy balances, preparation of flow sheets, design of selected plant items, an assessment of factors affecting plant safety and environmental impact, estimation of plant cost and process economics, preparation of a design report and drawing of plant lay-out.

CHEM ENG 4036

Pharm Manufacturing & Packaging Systems

3 units - semester 1

Up to 4 hours per week

Assessment: final exam 70%, project reports and assignments 30%

This aims of this course is to introduce the fundamental concepts of pharmaceutical manufacturing, quality control and intergraded packaging validation. The course also introduces the requirements for design of facilities, equipment and processes in the pharmaceutical and related industries

CHEM ENG 4037

Pharm Eng Research Project (N)

3 units - semester 2

Up to 1.5 hours per week

Assessment: project reports, seminar assessment

Candidates are required to complete satisfactorily an open-ended project and submit a written report on a topic supplied by the School and present a seminar/poster at the end of the semester summarizing results

CHEM ENG 4038

Particulate Processes & Colloids Science

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: CHEM ENG 2012

Assessment: exam 70%, project reports and assignments 30%

The aims of this course are to introduce particulate process theory, the concepts of surface and colloid science and to investigate applications of colloidal and particulate phenomena in pharmaceutical systems

CHEM ENG 4039

Environmental Engineering

3 units - semester 1 or semester 2

Up to 4 hours per week

Available for Non-Award Study

Incompatible: CHEM ENG 4024

Assessment: Examinations 70%; Assignments 30%

The study of air and water pollution; pollutant dispersion; control equipment; primary, secondary and tertiary wastewater treatment; water treatment, landfill and hazardous wastes.

CHEM ENG 4040

Chem Eng Research Elective

3 units - semester 2

Up to 1.5 hours per week

Assessment: project reports, seminar assessment

Candidates are required to complete satisfactorily an open-ended project and submit a written report on a topic supplied by the School and present a seminar/poster at the end of the semester summarizing results

CHEM ENG 4041

Chemical Engineering Projects IV

3 units - semester 1

Up to 9 hours per week

Incompatible: CHEM ENG 4025

Assessment: Project reports

Students are to undertake 108 hours of practical work on a series of projects based on lectures. Emphasis will be placed on teamwork and project Management.

CHEM ENG 4042

Chemical Eng Research Project (N)

3 units - semester 2

Up to 1.5 hours per week

Assessment: project reports, seminar assessment

Candidates are required to complete satisfactorily an open-ended project and submit a written report on a topic supplied by the School and present a seminar/poster at the end of the semester summarising results

CHEM ENG 4043

Special Studies in Chemical Engineering

3 units - semester 1 or semester 2

Up to 4 hours per week

Available for Non-Award Study

Incompatible: CHEM ENG 4001

Assessment: Assignments, examinations

Special topics in chemical engineering as determined by the Head of the School of Chemical Engineering. The course will be offered from time to time and may be taught by visiting academics

CHEM ENG 4044

Minerals Processing

3 units - semester 1 or semester 2

Up to 4 hours per week

Incompatible: CHEM ENG 4004

Assessment: Examination 70%; Tutorials/assignments 30%

The application of Chemical Engineering principles to minerals processing operations including flotation, size reduction, gravity separation, hydrometallurgy, pyrometallurgy and electrometallurgy

CHEM ENG 4045

Introduction to Nanotechnology

3 units - semester 1

Up to 4 hours per week

Assessment: Assignments: 40%; Design project: 60%.

Background: What is the nanoscale and what makes it different from other scales: why the nanoscale is important; case studies demonstrating non-classical behavior at the nanoscale; health and environmental implications of nanotechnology. Current and emergent nanotechnologies: nanocomposites; biosensors; etc. Top-down manufacture: vapor deposition; etching; lithography; etc. Nanotechnology instrumentation and characterization: atomic force microscope (AFM); scanning tunneling microscope (STM). Bottom-up manufacture: self assembly; nanofactories. Design and analysis of nanotechnologies: forces at the molecular and nanoscales; molecular and mesoscale modeling.

CHEM ENG 4046

Combustion Processes

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assessment: Assignments, examinations

Basic principles which form the background to combustion phenomena. Topic include explosions in closed vessels, flames and combustion waves, detonation waves in gases, combustion of hydrocarbons, combustion in mixed and condensed phases, high explosives, heating applications, combustion and the environment

CHEM ENG 4047

Chemical Engineering Research Project (H)

3 units - semester 2

Up to 1.5 hours per week

Incompatible: CHEM ENG 4026

Assessment: project reports, seminar assessment

Candidates are required to complete satisfactorily an open-ended project and submit a written report on a topic supplied by the School and present a seminar/poster at the end of the semester summarising results

CHEM ENG 4048

Biofuels, Biomass and Wastes

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assessment: Assignments, examinations

Fundamental concepts in understanding biofuels/bioenergy systems; renewable feedstocks, their production, availability and attributes for biofuel/bioenergy production; types of biomass derived fuels and energy; thermochemical conversion of biomass to heat , power and fuel; biochemical conversion of biomass to fuel,; biodiesel production; environmental aspects of biofuel production; economics & life-cycle analysis of biofuel; value adding of biofuel residues; case studies on biofuel production

CHEM ENG 4049

Biomolecular Engineering

3 units - semester 1 or semester 2

Up to 4 hours per week

Available for Non-Award Study

Incompatible: CHEM ENG 4008

Assessment: Assignments, examinations

Coursework includes fundamentals of microbiology; the growth curve; proteins and enzymes; kinetics of enzyme-catalysed reactions; applied enzyme catalysis; industrial enzyme processes kinetics of substrate utilisation, product formation, bio-mass production in cell cultures and inactivation (death) of cells; design and analysis of biological reactors, sterilisation, bio-applications, product recovery operations and bio-process economics.

CHEM ENG 4050

Chem Eng Application D

3 units - semester 1

Up to 4 hours per week

Pre-Requisite(s): Level 2 Maths

Assumed Knowledge: CHEM ENG 3031

Assessment: Final Exam: 70%; Tutorials/assignments: 30%

This course covers two parts, transport phenomena and advanced process control. Transport Phenomena deals with transport of momentum, thermal energy and mass by molecular means. The concept of shell balance and equations of change, in both thermal and isothermal systems, is used to obtain key Chemical Engineering transport equations. The advanced process control covers the following topics: Open-loop unstable systems, cascade control and dead time compensation, digital control and z transform, MIMO systems, interaction, RGA.

CHEM ENG 4051

Water and Wastewater Engineering

3 units - semester 1

Assessment: 60% final examination, 40% projects & tutorials

Water Chemistry; characteristics of water & wastewater; primary, secondary & tertiary treatment processes; sludge disposal; design of treatment plants.

Civil and Environmental Engineering

C&ENVENG 1008

Engineering Planning and Design 1A

3 units - semester 1

Up to 5 hours per week

Available for Non-Award Study

Assumed Knowledge: High school Physics & Maths (basic algebra, geometry & calculus)

Assessment: exam 50%, design practical 35%, quizzes and participation 15%

Introduction to engineering: engineering planning and design methodology: basic systems concepts; creative aspects of design; economic, environmental and social evaluation of engineering projects; introduction to economic and environmental economics; decision theory; scheduling: engineering ethics; sustainability; engineering practice; safety and safe design; case studies.

C&ENVENG 1009

Civil and Environmental Engineering 1A

3 units - semester 2

48 hours lectures, tutorials and design practicals

Available for Non-Award Study

Pre-Requisite(s): C&ENVENG 1010

Assumed Knowledge: High school Physics & Maths (basic algebra, geometry & calculus)

Assessment: 3 design projects, exam

This course provides an introduction to civil and environmental engineering design covering the sub-discipline areas of water,

structural and geotechnical engineering. Students will work in small groups to produce designs, utilising basic theory and simple design procedures covered in lectures. This group work will develop the key engineering attributes of team and communication skills. The course also involves producing civil engineering drawings. The design process and safety are also covered.

Part of the course will be devoted to framing and solving unstructured problems by discussing a variety of puzzles. Such educational puzzles are used to illustrate basic concepts of critical thinking, mathematics, and problem-solving.

C&ENVENG 1010

Engineering Mechanics - Statics

3 units - summer semester or semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: High school Physics & Maths (basic algebra, geometry, calculus)

Assessment: exam 60%, in-class tests (40%, ie 2X20% each)

This course familiarises students with the principles of static equilibrium by applying Newton's laws of motion to solve engineering problems. Topics will be taken from: introduction to forces; 2D and 3D equilibrium of particles and rigid bodies; centre of gravity and centroids; distributed loading and hydrostatics; friction; analysis of structures including trusses, frames and machines; and drawing shear and bending moment diagrams. The course finishes with an introduction to approximate analysis techniques for statically indeterminate structures. Emphasis is placed on drawing free-body diagrams and self-checking strategies.

C&ENVENG 1012

Engineering, Modelling and Analysis 1A

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: Year 12 Mathematics

Assessment: 3 hour exam - including theory & practical assignments - run in CAT suite. Also includes projects and assignments throughout semester

This course serves as an introduction to how engineers typically solve real world and complex problems. In many cases mathematical or analytical solutions are not available and numerical or computer methods must be used. This course will introduce this important area and provide training in its fundamental components. These include: Introduction to computer theory and computing environments; Development of programming skills in Fortran 90/95, Visual Basic in Excel (VBA) and Matlab; Development of programs that are well-structured and can be easily maintained; Introduction to probability and statistics and Monte Carlo simulation techniques.

Introduction to numerical methods in engineering, including: Approximations and errors; Solving large sets of Linear algebraic equations; Roots of equations; Numerical differentiation and integration; Solution of ordinary differential equations.

C&ENVENG 2025

Strength of Materials IIA

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Civil & Struct), BE(Mining) & associated double degree students only

Available for Non-Award Study

Pre-Requisite(s): C&ENVENG 1010 & MATHS 1012

Assessment: exam, assignments

Topics to be chosen from: elastic and elastic-plastic behaviour; plane stress and strain; constitutive relationships, principal stress and strain; failure criteria; stresses in thick cylinders; bending and shearing stresses in beams; Mohr's circle; deflections of beams; Euler buckling; short and long columns; torsion of solid and hollow circular sections; elastic axis; introduction to statical indeterminacy and simple redundant structures; work and strain energy concepts.

C&ENVENG 2067

Construction, Management & Surveying

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Incompatible: C&ENVENG 2015

Assessment: Exam 60%, Coursework 40%

The aim of this course is to introduce students to the practical aspects of the construction industry. In particular, this will involve: Engineering construction terminology; Common construction methods and processes; Project organisation and management; Contracts and specifications; Elementary surveying principles; and Familiarisation with selected surveying equipment. Topics include: Overview of the construction and engineering industries; Contracts, specifications and tendering; Occupational health safety and welfare, Industrial relations; Project management, scheduling, quality assurance, environmental aspects of construction, engineering ethics; Civil construction - earthworks, embankments, foundations, retaining structures, pavements and tunnels; Construction using concrete, steel, timber and masonry; Residential construction; Construction of bridges, dams, tunnels, skyscrapers and domes; Introduction to civil engineering surveying incorporating: Linear measurement; Levelling; Theodolite; Horizontal and vertical curves; safety in practice.

C&ENVENG 2068

Environmental Engineering & Sustainability II

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1008 & C&ENVENG 1009

Incompatible: C&ENVENG 2026

Assessment: tests/quizzes, assignments/projects, exam - Details provided at start of course

This course explores the relationship between engineers and one of our most valuable natural resources - river systems. The themes covered include the value of river systems, the modifications that have been made to river systems as a result of engineering activities, some of the negative impacts this has had, and continues to have, on our natural resources, as well as the role engineering plays in rehabilitating and managing these resources and ensuring the mistakes of the past will not be repeated by adopting sustainable planning and design practices. Specific topics might include: River Modification and Rehabilitation, Water Quality Parameters, Water Quality Modelling, Fish Passage, Environmental Flows, Erosion Control, Social Impact, Sustainable Design and Environmental Decision-Making. The course features a design project on river restoration and rehabilitation, as well as the multi award-winning Mekong e-Sim, which is a roleplay/simulation

centred on development issues in the Mekong River in south-east Asia.

C&ENVENG 2069

Geotechnical Engineering IIA

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: C&ENVENG 1010, MATHS 1011 & MATHS 1012

Incompatible: C&ENVENG 2006

Assessment: Exams 70%, Coursework 30%

The course provides an understanding of: the nature of soils and their variability; and the state and behaviour of a soil. Topics include:

The Origin and Composition of Soils: Introduction to geotechnical engineering, processes that form soils, clay mineralogy; Phase relationships, Atterberg Limits and Soil Classification: Soil state definitions, phase relationships, grain size analyses, Atterberg limits, soil classification and description; Vertical Stress in Soils: Soil suction, total vertical stress, pore water pressure, effective vertical stress; Flow of Water Through Soils: Water flow, permeability, 2D seepage and measurement; Consolidation: Introduction to consolidation theory, oedometer test, overconsolidation ratio, consolidation settlement, time rate effects, sand drains; Strength of Soils: Shear strength of sands and clays, Mohr-Coulomb failure criterion, direct shear test, triaxial test, stress paths, Skempton's pore pressure parameters; Soil Improvement: Compaction - concepts, measurement and field techniques, Overview of other soil improvement techniques; Stability of Slopes: Landslides, Taylor's charts, Bishop's method of slices.

C&ENVENG 2070

Engineering Modelling and Analysis IIA

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: C&ENVENG 1012

Incompatible: C&ENVENG 2014

Assessment: 3 hour exam - including theory & practical assignments - run in CAT suite. Also includes assignments throughout semester

This course serves as an extension to Engineering, Modelling and Analysis 1A to study methods used by engineers to solve real world and complex problems. In many cases mathematical or analytical solutions are not available and numerical or computer methods must be used. Fortran 90/95 and Visual Basic in Excel (VBA) programming skills are extended and applied to a number of engineering applications.

This course covers a range of practical engineering modelling and analysis methods that engineers use to solve real world and complex problems. The components include: Roots of Equations; Systems of Linear Equations; Polynomial Interpolation And Cubic Splines; Numerical Integration and Differentiation; Numerical Solution of Ordinary Differential Equations; Common probability distributions including normal and log-normal distributions; Monte Carlo simulation; Finite difference methods; and Fourier transform spectral methods.

C&ENVENG 2071

Water Engineering IIA

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1010 & MATHS 1012 or MATHS 1014

Incompatible: C&ENVENG 2033 or C&ENVENG 2035

Assessment: Exam 60%, Assignments and quizzes 15%, Laboratories 10%, Design 15%

An introduction to hydraulic engineering and fluid mechanics. Description and properties of fluids: hydrostatics; buoyancy and stability; laws of inviscid flow; continuity, energy and momentum equations; dimensional analysis and model theory; steady uniform and non-uniform flow of liquids in closed conduits; flow of real fluids; friction in open and closed conduits, Moody diagram; laminar flow; types of turbulent flow; viscous sublayer; flow measurement in pipes and open channels; steady uniform flow in open channels, hydraulic jumps. Uniform and non-uniform flow in open channels, super and subcritical flows; hydraulic structures and dissipator design; flow measurement techniques; computation of water surface profiles in open channel flow.

C&ENVENG 2072

Structural Engineering Design

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1010 & C&ENVENG 2025

Incompatible: C&ENVENG 2032

Assessment: May include assignments and/or exam or quizzes - details at start of course

Iterative nature of the design procedure developed through a truss design, construct and test project, and the preliminary design of a reinforced concrete frame. Topics covered include: limit states; gravity and wind loads; fundamental principles that govern the behaviour of reinforced concrete and steel structures; buckling of slender members and effective lengths; connections for steel members

C&ENVENG 3001

Structural Mechanics IIIA

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Civil & Struct), BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2025

Assessment: coursework, exam

This course is intended to provide students with a thorough understanding of the theory and application of structural analysis as it applies to trusses, beams and frames. Emphasis is placed on developing the student's ability to both model and analyse statically determinate and indeterminate structures and to provide realistic applications encountered in professional practice. Topics to be chosen from: Influence lines; Approximate methods of analysis; Calculation of deflections in statically determinate structures by the moment-area theorems, the conjugate beam method, the principle of virtual work and Castigliano's theorem; Force method of analysis for indeterminate structures; Displacement methods of analysis for indeterminate structures including the slope-deflection method, method of moment distribution, and the stiffness method; an introduction to finite element modelling.

C&ENVENG 3005

Structural Design III (Concrete)

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Civil & Struct), BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2032, C&ENVENG 2034, C&ENVENG 2025 & C&ENVENG 3001

Assessment: may include assignments and/or exam or quizzes - details at beginning of semester

The aim of this course is to provide students with a thorough understanding of the design of reinforced concrete structures. Topics covered will include:

-Design of beams for flexure; development and detailing of flexural reinforcement.

-Behaviour of reinforced concrete members under combined flexure and axial load; design of short columns; behaviour and design of slender columns.

-Introduction to reinforced concrete wall systems and design of bearing walls and retaining walls.

-Behaviour and design of reinforced concrete members for shear.

C&ENVENG 3007

Structural Design III (Steel)

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Civil & Struct), BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2032, 2034, 2025

Assessment: may include assignments and/or exam or quizzes - details at beginning of semester

The aim of this course is to provide students with a thorough understanding of the iterative nature of design and the fundamental principles on which the analyses are based.

The course covers the design and analysis of a multi-storey steel and composite braced frame for local and global buckling as well as material failure. Wherever possible, analyses are based on fundamental principles which can be used by anybody anywhere in the world and are assessed through quizzes and/or exams. The course also includes an open ended design topic, often outside the scope of existing national standards, to develop the students' ability as an engineer and problem solver and which is assessed through the submission of a report. Topics are taken from: steel beams; composite steel and concrete beams; steel columns; retrofitting of steel columns and beams; retrofitting of composite beams; and permanent and temporary bracing and propping.

C&ENVENG 3012

Geotechnical Engineering Design III

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Civil & Struct), BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2069

Assessment: exams 60%, coursework 40%

The course is intended to introduce the student to the fundamentals of Soil Mechanics, in particular the analytical aspects of the subject. Design procedures will be introduced through problem solving, emphasising the role of idealisation of the field problems. Topics covered in the course include: site investigations and data collection; lateral earth pressures and retaining wall design; foundation design; loading induced stresses and displacements; bearing capacity of shallow foundations; analysis and design of shallow foundations; analysis and design of pile foundations; pavement design; environmental geotechnics.

C&ENVENG 3077

Engineering Hydrology

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1002, C&ENVENG 2068 & C&ENVENG 2071

Incompatible: C&ENVENG 2035

Assessment: Online Quizzes (10%), Design Projects / Tutes (40%), Exam (50%)

The course serves as an introduction to the field of engineering hydrology. It covers fundamentals such as the hydrological cycle, catchments, losses, hydrographs and hyetographs, as well as topics such as: flood frequency analysis, determination of design rainfall intensity and hyetographs, peak flow estimation, design hydrograph estimation, groundwater processes and modelling.

C&ENVENG 3078

Engineering Management & Planning IIIA

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1008

Incompatible: C&ENVENG 3011

Assessment: assignments, tutorials, oral presentation, exam

This course is intended to develop generic professional and management skills that students require in practice. Topics include: Time management and other self management skills; project management; management in organisations; communication skills; engineering economics; quality management; sustainability in the planning / decision making process; applications to civil and environmental engineering practice; safety and risk Management.

C&ENVENG 3079

Water Engineering & Design III S2

3 units - semester 2

Up to 4 hours per week, plus field trip

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2071

Incompatible: C&ENVENG 3013 & C&ENVENG 3014

Assessment: exam 65%, assignments/laboratories/design 35%

Closed Conduit Flows: Hydraulic engineering design. Elements of pipeline and network design; pipes in series; pipes in parallel; Hardy Cross method for solving pipe networks; unsteady flow and water hammer in closed conduits; method of characteristics; water hammer control devices; hydraulic machine basics and selection including pumps and turbines; water distribution system computer simulation modelling, EPANET. Design of water distribution systems. Consideration of carbon in design of water distribution systems. Open Channel Flow: Non-uniform flow in open channels, spillway design, flow in erodible channels, unsteady flow in open channels; rapidly varied flow in open channels; level pool routing; environmental factors affecting river basins.

C&ENVENG 4003A

Civil and Struct Engineering Research Project Pt 1

Pre-Requisite(s): Students must enrol in Part A in semester prior to Part B

Co-Requisite(s): C&ENVENG 4003B

C&ENVENG 4003B

Civil and Struct Engineering Research Project Pt 2

6 units - full year

Up to 10 hours per week

Restriction: Available to BE(Civil & Struct) & associated double degree students only

Pre-Requisite(s): C&ENVENG 4003A

Assessment: evaluation of research including: research report, conference paper, literature review, oral presentations

Students work in groups on a research project under the supervision of an academic staff member. Key steps include the production of a research proposal which includes a critical literature review, identification of appropriate research gaps, and a detailed methodology. All groups are expected to produce a safe work plan and liaise with staff, including laboratory personnel, as appropriate. The final outcomes are presented at a one day conference which includes the production of a printed proceedings.

C&ENVENG 4005A

Civil and Environmental Research Project Part 1

Restriction: Available to BE(Civil & Struct) & associated double degree students only

Pre-Requisite(s): Students must enrol in Part A in semester prior to Part B

Co-Requisite(s): C&ENVENG 4005B

C&ENVENG 4005B

Civil and Environmental Research Project Part 2

6 units - full year

Up to 10 hours per week

Restriction: Available to BE(Civil & Struct) & associated double degree students only

Pre-Requisite(s): C&ENVENG 4005A

Assessment: evaluation of research including: research report; conference paper; literature review; oral presentations.

Students work in groups on a research project under the supervision of an academic staff member. Key steps include the production of a research proposal which includes a critical literature review, identification of appropriate research gaps, and a detailed methodology. All groups are expected to produce a safe work plan and liaise with staff, including laboratory personnel, as appropriate. The final outcomes are presented at a one day conference which includes the production of a printed proceedings.

C&ENVENG 4034

Engineering Management IV

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE(Architectural) & associated double degree students only

Available for Non-Award Study

Incompatible: ELEC ENG 4040

Assessment: may include assignments &/or exam - further details available at beginning of semester

This course includes group decision-making, the development of the individual, and the importance of communication and interpersonal skills in the engineering environment. Students gain an understanding of work preferences and personal interactions through self-analysis, experience and reflection. These skills are developed through group projects, presentations and a competitive engineering proposal. Risk assessment and safety in engineering design and practice are also included

C&ENVENG 4037

Introduction to Environmental Law

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE (Civil & Env) & associated double degree students only

Available for Non-Award Study

Assessment: may include assignments and/or exam - further details available at beginning of semester

The course examines regulatory mechanisms that address environmental problems and focuses particularly upon regulation of development. Included are: a general introduction to the law and the legal system; the nature of environmental problems in Australia; constitutional responsibilities and powers with respect to environmental planning and protection; land-use planning and protection systems; environmental impact assessment; regulation of pollution and waste disposal; and environmental litigation.

C&ENVENG 4068

Computer Methods of Structural Analysis

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 3001, C&ENVENG 3007 & C&ENVENG 3005

Assessment: assignments, project work and examination - further details at beginning of semester

The objective of this course is to provide students with a thorough understanding of the theory and application of computer methods of structural analysis including Matrix Methods of structural analysis and the Finite Element Method. Topics include analysis of two and three dimensional trusses and frames; basic concepts of elasticity; formulation of different finite elements for plane stress, plane strain, axisymmetric and plate bending problems. Students will develop their own computer program and they will also use commercial software for analysing structures.

C&ENVENG 4069

Advanced Reinforced Concrete

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 3001, C&ENVENG 3005

Assessment: assignments, exam

This course is intended to provide students with a deeper fundamental understanding of the behaviour of reinforced concrete (RC) structures. Emphasis will be placed on inelastic behaviour of RC members. Topics covered will include: elastic and inelastic response of RC members; confinement of RC columns; behaviour

of RC beams in shear; and use of new and advanced materials in RC

C&ENVENG 4070

Seismic Design of Masonry Buildings

3 units - semester 2

Up to 3 hrs per week, plus directed study and/or design

Restriction: students in specified programs only, please check Academic Rules of the program in which you are enrolling

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 3001 Structural Mechanics IIIA, C&ENVENG 3007 Structural Design III (Steel), C&ENVENG 3005 Structural Design III (Concrete)

Assessment: coursework 40%, final exam 60%

Students will learn in this course how the basic stiffness method of structural analysis for static loading is extended to analyse the dynamic response of structures subject to dynamic loading such as that caused by earthquake. Emphasis will be placed on practical elastic and inelastic analysis techniques. Simplified methods for characterisation of dynamic loads as "equivalent" static forces and the treatment of structural damping will also be covered. Students will also learn how to design unreinforced masonry buildings with special emphasis on earthquake loading.

C&ENVENG 4071

Special Topics in Civil and Struct Engineering IV

3 units - semester 1 or semester 2

Up to 3 hours per week plus directed study

Restriction: Available to BE(Civil & Struct) & associated double degree students only

Available for Non-Award Study

Assessment: may include assignments and/or exam - details at beginning of semester

Advanced topics in civil and structural engineering.

C&ENVENG 4073

Water Distribution Systems and Design

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE (Civil & Env), BE (Civil & Struct), BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2033, C&ENVENG 2035, C&ENVENG 3013 & C&ENVENG 3014

Assessment: exam 60%, tutorial, project work 40%

Water distribution systems analysis. Steady state analysis of pipe networks. Alternative formulations of equations for pipe networks. Computer solution techniques. Water supplies for small communities. Optimisation of pipe networks/design. Operation and sustainability using genetic algorithms. Water hammer analysis. Pump transients. Water hammer control methods.

C&ENVENG 4075

Water Resources Optimisation and Modelling

3 units - semester 2

Up to 3 hours per week

Restriction: Available to BE(Architectural) and BE (Civil&Environmental) students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2033, C&ENVENG 2035, C&ENVENG 3011

Assessment: may include assignments, presentations, projects and/or exam - details at beginning of semester

The systems approach to water resources planning and management

The role of simulation and optimisation models

Review of optimisation techniques and their application to water resources planning and management.

- Optimisation techniques considered: linear programming, separable programming, non-linear optimisation, multi-objective optimisation, genetic algorithms, ant colony optimisation

- Application areas: reservoir planning, reservoir operations, water quality management, groundwater utilisation, river basin planning, capital budgeting, water allocation, stormwater reuse, wastewater treatment

C&ENVENG 4077

Coastal Engineering and Design

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Civil & Env) & associated double degree students only

Available for Non-Award Study

Assessment: exam 60%, design and tutorials 40%

The course is based on developing an understanding of the theory and application of waves, tides and sediment transport and their application in the nearshore coastal zone. Other topics include nearshore processes, statistical modelling of return periods, offshore outfalls, beach protection, wave generation, harbour design, and coastal Management.

C&ENVENG 4079

Deep Foundation Engineering and Design

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE(Architectural) and BE (Civil&Environmental) students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2006, C&ENVENG 3012

Assessment: exam 50%, coursework 50%

When soil conditions at shallow depth are inadequate to carry loads then pile foundations are employed. This course covers the theoretical analysis and design of deep foundations. The loads transmitted can be vertical or lateral loads, and moments. Pile foundations are able of transferring these loads to deeper strata through friction and end-bearing. The ultimate capacity of single piles and pile groups under axial and lateral loading as well as the settlement or lateral deflection of single piles and pile groups are covered.

C&ENVENG 4081

Engineering Problematic Soils

3 units - semester 1

Up to 3 hours per week plus project work

Restriction: Available to BE(Civil & Env) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2006 & C&ENVENG 3012

Assessment: 2 design projects (50%), Final exam (50%)

The course examines soils which are particularly problematic, from an engineering perspective, and develops engineering solutions. In particular, the following topics are treated: (1) expansive soils: The nature, behaviour, formation and distribution of expansive soils in the urban environment; soil suction and its measurement; the definition, measurement and accuracy of instability index and surface heave; design of residential footings on expansive soils; assessment and remediation of residential structures damaged as a result of expansive soil movement; (2) quick and soft clays; (3) collapsible soils; (4) dispersive clays; (5) organic soils; (6) acid-sulfate soils; (7) soils susceptible to liquefaction; and (8) frozen soils. Engineering solutions to each of these problematic soils are presented including geosynthetics.

C&ENVENG 4085

Traffic Engineering and Design

3 units - semester 1

Up to 3 hours per week plus directed study

Restriction: Available to BE(Civil & Env), BE(Civil & Struct), BE(Architectural) & associated double degree students only

Assumed Knowledge: C&ENVENG 3011

Assessment: may include assignments and/or exam - details at beginning of semester

Elements of the road traffic system. Road safety and safe systems principles. Road hierarchy and functional classification. Design of urban road networks. Introduction to traffic analysis. Traffic control devices and systems. Traffic management principles and applications. Local area traffic management. Design of traffic systems. Traffic calming principles. Traffic flow and road capacity analysis. Principles of traffic signal operation. Introduction to road design

C&ENVENG 4087

Environmental Modelling & Management

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Civil & Env) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2068

Assessment: tests/quizzes, assignments/projects, exam - details provided at start of course

The course addresses the major steps in the development of engineering models, and how they are used for decision-making, with a particular emphasis on water quality and adaptation to climate change. Topics to be covered include one or more of the following: model specification (environmental processes, model complexity, model application), model calibration (gradient methods, genetic algorithms, ant colony optimisation), model validation and stochastic modelling (types of uncertainty, random variables, risk-based performance measures and reliability analysis, including Monte Carlo simulation and the first-order reliability method), artificial neural network modelling, environmental decision-making.

C&ENVENG 4090

Special Topics in Civil and Environ Engineering IV

3 units - semester 1 or semester 2

Up to 3 hours per week

Restriction: Available to BE(Civil & Struct) & associated double degree students only

Available for Non-Award Study

Assessment: may include assignments & exam - details at start of semester

Advanced topics in civil and environmental engineering.

C&ENVENG 4091

Waste Management Analysis and Design

3 units - not offered in 2011

Up to 3 hours per week

Restriction: Available to BE(Civil & Env), BE(Civil & Struct), BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2026, C&ENVENG 3003 or C&ENVENG 3009

Assessment: may include assignments & exam - details at start of semester

Generation, collection and disposal of solid waste; sanitary landfill; incineration; resource conservation and recovery; fuel recovery. Hazardous waste management; types of hazardous waste; treatment technologies; methods of disposal; design project.

C&ENVENG 4092

Wastewater Engineering and Design

3 units - not offered in 2011

Up to 3 hours per week plus project work

Restriction: Available to BE(Civil & Env), BE(Civil & Struct), BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2033, C&ENVENG 2035, C&ENVENG 3013 & C&ENVENG 3014

Assessment: may include written assignments & exam - details at start of semester

Characteristics of wastewater; primary, secondary and tertiary treatment methods; sludge disposal; project: design of wastewater treatment plant

C&ENVENG 4096

FRP Retrofitting of Concrete Structures

3 units - semester 1

Up to 3 hrs per week plus directed study and/or design

Restriction: students in specified programs only, please check Academic Rules of the program in which you are enrolling

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 3001 Structural Mechanics IIIA, C&ENVENG 3005 Structural Design III (Concrete)

Assessment: design report, assignment and exam - details at beginning of semester

The maintenance, upgrade, strengthening and stiffening of existing reinforced concrete structures is a large growth area in civil engineering. A new retrofitting technique using externally bonded plates, in particular fibre reinforced polymer (FRP) plates, is being developed and applied in practice worldwide and has been found to be convenient, inexpensive and unobtrusive. FRP retrofitting of concrete structures is a new emerging technology and as such national standards or codes are not available. To overcome this problem, this course teaches the fundamental principles that govern the behaviour of this emerging technology to provide the student with a deep understanding in order to derive a safe design. The course covers: intermediate crack debonding theory; the moment-curvature approach to plating; the moment-rotation approach to

plating; design for moment redistribution to optimise the increase in strength; and both ultimate and serviceability limit states.

C&ENVENG 4097

Analysis of Rivers and Sediment Transport

3 units - not offered in 2011

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2033, C&ENVENG 2035, C&ENVENG 3013, C&ENVENG 3014 or equivalent

Assessment: exam 50%, tutorials/design 30%, practicals 20%

This course will examine advanced topics in open Channel Flow such as curvilinear flows, unsteady flow, super-critical transitions. These will be followed by an introduction to River Mechanics and modelling flow in 2D and 3D situations, such as meandering channels and flow around piers and other structures. The course will then introduce concepts in sediment transport and examine techniques to predict the threshold of motion, sediment transport rates as well as local scour and morphology changes. The lectures will be used to introduce topics and the students will be expected to gain a greater understanding of the material through the design and tutorials and through their own self study.

C&ENVENG 4098

Water Resources Sustainability and Design

3 units - not offered in 2010

Up to 3 hours per week

Restriction: Available to BE(Architectural) & BE(Civil&Environmental) students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2033, C&ENVENG 2035, C&ENVENG 3011, C&ENVENG 3013, C&ENVENG 3014

Assessment: essay, short talk, design project, exam

Reliability and sustainability issues of water resources; drought assessment; multi objective evaluation of water resources projects; sustainability assessment and modelling; design project.

C&ENVENG 4099

Structural Response to Blast Loading

3 units - not offered in 2011

Up to 3 hours per week

Restriction: Available to BE(Architectural) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: APP MTH 2010, GEOLOGY 2005, C&ENVENG 2014 & C&ENVENG 3008

Assessment: assignments and/or quizzes

With the increased world tension, terrorist bombing attacks are becoming a more and more realistic threat to society. These terrorist attacks usually target populated facilities such as office buildings and hotels, as well as diplomatic and military facilities, resulting in not only enormously economic loss, but also injuries and fatalities, social disruption and psychological impact to society. To reduce the consequences, it is essential to study characteristics of structural response to blast loading and to develop effective blast resistant systems that can be applied to protect the building's occupants. In this course, theory of wave propagation in media is addressed first; then empirical formulae to estimate blast loads around a structure at difference scaled distances are described; after that material models for reinforced concrete and masonry under high strain rate are reviewed; later on characteristics of structural response to blast loading is analyzed and blast design procedures for structural members are introduced; finally retrofitting technologies are developed to strengthen RC and masonry structures against blast loading

C&ENVENG 4106

Introduction to Geostatistics

3 units - summer semester

Up to 3 hours per week

Assumed Knowledge: Basic geology; elementary statistics (mean, variance, histogram)

Assessment: coursework 50%, examination 50%

Basic introduction to geostatistics with the emphasis on concepts rather than mathematics. Regionalised (or spatial) variables. Quantifying the criteria for estimation sources of errors in estimation, fundamental basis of the geostatistical approach, mean and variance of the estimation error. The variogram calculation, interpretation, linking variogram behaviour with physical causes (geology, sampling). Variances, covariances, Krige's volume-variance relationship. Extension variances and estimation variances/simple calculations in one and two dimensions. Global reserve/resource estimation. Optimal estimation and introduction to kriging.

C&ENVENG 4107

Prestressed Concrete Structures

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 3005 & C&ENVENG 3001

Assessment: Tutorials (15%), design projects (30%) and a final examination (55%)

Introduction to Prestressed Concrete-Prestressing concepts; pre-tensioning and post-tensioning; full and partial prestress; the need for prestress; advantages and disadvantages; methods of prestressing. Forces Imposed by prestressing (Straight, Draped And Kinked Tendon Profiles). Load Balancing. Introductory Examples. Design Requirements: Strength And Serviceability. Material Properties.

Design for Serviceability: Stress limits; Serviceability criteria; Determination of prestress and eccentricity.; Cable profiles; Cracked section analysis; decompression and cracking moment; Effect of cracking at service loads; Short-term deflection calculations; Crack control; Design for Strength: Limit State Design. Rectangular Stress Block. Ultimate Moment Capacity. Effect of Non-Prestressed Steel; Ductility; Transfer Strength; Design For Shear-Effect of Prestress on Shear; Stirrup Design.

Special problems in prestressing: Losses; effect of creep and shrinkage; End Block Design-Bursting and Spalling Forces in Post Anchorages; Transmission Lengths in Pre-tensioned members.

Statically Indeterminate Beams: Introduction to Continuous Prestressed Concrete Beams; Secondary Moments; Method of Equivalent Loads; Load Balancing; Practical Tendon Profiles; Moment Redistribution; Secondary Effects at Ultimate.

C&ENVENG 4108

Environmental Engineering and Design IVA

3 units - semester 1

Up to 4 hrs per week

Assumed Knowledge: C&ENVENG 4087, C&ENVENG 3079, C&ENVENG 3077, ECON 3018 & ENV BIOL 2005

Assessment: Assignments, quizzes, major design project

Natural environments are complex systems involving many different drivers and interacting components. Such components include the ecological processes of species interaction, the physical processes of contaminant transport, and the human processes driven by social values, policy and economics. This course presents a dynamic systems approach towards understanding and modelling environmental systems. The emphasis will be on the development and analysis of models that describe the material flows and feedback processes within environmental systems, and the influence of environmental management. The dynamic systems framework will be applied to some of the following systems: surface water contamination; predator-prey systems; air pollution; species migration; and matter cycling in ecosystems. The project will involve an environmental design, or an environmental impact study.

C&ENVENG 4109

Environmental Engineering and Design IVB

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: C&ENVENG 4087, C&ENVENG 3079, C&ENVENG 3077, ECON 3018, ENV BIOL 2005 & C&ENVENG 4037

Assessment: Assignments, designs and presentations

The course aims to introduce the design principles and tools used to undertake Integrated Urban Water Management (IUWM). The IUWM design paradigm aims to increase the long-term sustainability of urban water systems by placing a greater emphasis on household and subdivision scale water management solutions including raising public awareness, implementation of domestic water restrictions, provision of demand management incentives (installing water saving appliances) and support for alternative supply sources including rainwater tanks and water recycling. Topics covered will be selected from the following: (1) Water sensitive urban design approach to manage stormwater quantity and quality (2) Using household water use modelling to optimize alternative supply sources and/or demand management incentives to minimize urban water use (3) Evaluating the impact of small-scale IWUM on regional water supply systems sustainability considering aspects water supply security, climate change and cost-energy use trade-off's.

C&ENVENG 4110

Environmental Engineering and Design IVC

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 3077, C&ENVENG 2069, C&ENVENG 4037 & CHEM ENG 2017

Assessment: Design project 50%, final exam 50%

Industrial and agricultural contamination of soil and groundwater. Potential hazards to human health and the environment. Epidemiology. Planning and legislative issues in land-use change and redevelopment. International approaches. Site investigation: preliminary, exploratory, detailed and monitoring. Hydrogeology of site: trial pits, drilling, coring, sampling and pumping tests. Soil gas and vapour tests. Risk assessment: source-pathway-receptor concept; estimation, evaluation and control of risk. Modelling of pollutant transport above and below ground: advection, dispersion, absorption and transformation. Remediation options: removal, containment, hydraulic, thermal, physical, chemical, biological, and stabilisation. On-site and off-site options. Selection of options: feasibility, effectiveness, cost. Formal ranking procedures. Design and implementation: specification, technical design, project planning, supervision, documentation and reporting. Health and safety and environmental protection issues. Post project monitoring plan.

Computer Science

COMP SCI 1003

Internet Computing

3 units - semester 2

Up to 5 hours per week

Available for Non-Award Study

Assessment: written exam, assignments

Internet Architecture: Decentralisation, Tolerance, End-to-end Argument, Unambiguous Human-readable Naming, Packet Switching. Web Architecture: Least Power, Independent Invention, Evolvability, REST. Protocols: TCP/IP, SMTP, FTP, HTTP. Naming: DNS and URLs. Data Formats: HTML, XML, XML-Schema. Meta-data and the Semantic Web. Trust. Practicals: Web Programming using PHP.

COMP SCI 1007

Computer Science Concepts

3 units - semester 1 or semester 2

Up to 10 hours per week for first 6 weeks of semester

Restriction: approved students only

Available for Non-Award Study

Assessment: written exam, assignments

Programming in Java: variables, control structures, methods, classes, input/output; object orientation, interfaces, inheritance; introduction to graphical user interfaces. Introductory programming techniques in Java: recursion, artificial intelligence, finite state machines sorting and generics.

COMP SCI 1009

Computer Science IB

3 units - semester 1

Up to 5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1008

Assessment: written exam, assignments, practical exams

Programming via the Java language: recursion, event handling, and graphical user interfaces. Introduction to computer science: numerics, computer architecture, finite state machines, graphics, artificial intelligence, sorting and searching, theory of computation, ethics for Information Technology, introduction to complexity

COMP SCI 1010

Puzzle Based Learning

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE level 2 Maths Sciences

Assessment: Written exam, assignments

The focus of this course is on getting students to think about framing and solving unstructured problems (those that are not encountered at the end of some textbook chapter). The general objective is to increase the student's mathematical awareness and problem-solving skills by discussing a variety of puzzles. The puzzle-based learning approach has a long tradition as the first mathematical

puzzles were found in Sumerian texts that date back to around 2,500 BC The puzzles selected for the course satisfy most of the following criteria: a] Generality: educational puzzles explain some universal mathematical problem-solving principles; b] Simplicity: educational puzzles are easy to state and easy to remember; c] Eureka factor: educational puzzles often frustrate the problem-solver! Eventually a Eureka! moment is reached? The Eureka factor also implies that educational puzzles have often elementary solutions that are not obvious; d] Entertainment factor: educational puzzles are very entertaining!

Such educational puzzles are used to illustrate basic concepts of critical thinking, mathematics, and problem-solving. The course presents some problem-solving rules and covers issues of understanding the problem and the role of intuition in problem-solving activities. Further, some mathematical problem-solving principles are discussed and elements of modeling, constraint-processing, optimization, probability, statistics, simulation, pattern recognition, and strategy are introduced.

COMP SCI 1012

Scientific Computing

3 units - semester 1

Up to 5 hours per week

Available for Non-Award Study

Pre-Requisite(s): SACE stage 2 Mathematical Studies or equivalent

Incompatible: APP MTH 1000, APP MTH 2106, ENG 2002, CHEM ENG 1002 & APP MTH 2005

Assessment: written exam, assignments

This course provides an introduction to basic computer programming concepts and techniques useful for Scientists, Mathematicians and Engineers. The course exposes students to practical applications of computing and commonly used tools within these domains. It introduces techniques for problem solving, program design and algorithm development.

MATLAB (approximately 24 lectures): Basic programming: introduction to the MATLAB environment and the MATLAB help system, data types and scalar variables, arithmetic and mathematical functions, input and output, selection and iteration statements. Functions: user defined functions, function files, passing information to and from functions, function design and program decomposition, recursion. Arrays: vectors, arrays and matrices, array addressing, vector, matrix and element-by-element operations. Graphics: 2-D and 3-D plotting. Mathematical modelling: dynamical systems, linear systems, numerical differentiation and integration.

Spreadsheets (approximately 6 lectures): Spreadsheets as a tool for Scientific Computing: calculation, using in-built functions, plotting and fitting, modelling and optimisation using the Goal-Seek and Solver tools, data analysis.

COMP SCI 1101

Introduction to Programming

3 units - semester 1 or semester 2

Up to 6 hours per week

Restriction: Available to B Eng (Software Engineering) and other non-Engineering degree students only

Available for Non-Award Study

Pre-Requisite(s): SACE Stage 2 Mathematical Studies or equivalent

Incompatible: COMP SCI 1008, COMP SCI 1201

Assessment: Written exam, assignments

This course is designed for students with no prior programming experience. Students who have experience in procedural programming languages may consider taking COMP SCI 1102 Object Oriented Programming instead.

This course introduces the fundamental concepts of procedural programming. Topics include data types, control structures, functions, arrays, files, and the mechanics of running, testing, and debugging. The course also offers an introduction to the historical and social context of computing and an overview of computer science as a discipline.

Algorithms and problem-solving: Problem-solving strategies; the role of algorithms in the problem-solving process; implementation strategies for algorithms; debugging strategies; the concept and properties of algorithms

Fundamental programming constructs: Syntax and semantics of a higher-level language; variables, types, expressions, and assignment; simple I/O; conditional and iterative control structures; functions and parameter passing; structured decomposition

Fundamental data structures: Primitive types; arrays; records; strings and string processing

Software development methodology: Fundamental design concepts and principles; testing and debugging strategies; test-case design (black box testing and requirements testing); unit testing; programming environments

Human-computer interaction: Introduction to design issues

Social context of computing: History of computing and computers; evolution of ideas and machines; social impact of computers and the Internet; professionalism, codes of ethics, and responsible conduct; copyrights, intellectual property, and software piracy.

COMP SCI 1102

Object Oriented Programming

3 units - semester 1 or semester 2

Up to 6 hours per week

Restriction: Available to B Eng (Software Engineering) and other non-Engineering degree students only

Available for Non-Award Study

Pre-Requisite(s): SACE Stage 2 Mathematical Studies or equivalent

Assumed Knowledge: COMP SCI 1101

Incompatible: COMP SCI 1009, COMP SCI 1202

Assessment: Written exam, assignments

This course is designed as an entry level programming course for students who have prior programming experience. This course introduces the concepts of object-oriented programming to students with a background in the procedural paradigm.

Note: Students who do not have prior programming experience or who are not confident in their programming ability should complete COMP SCI 1101 Introduction to Programming prior to undertaking this course.

The course begins with a review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting techniques, and an introduction to software engineering issues.

- Review of control structures, functions, and primitive data types
- Object-oriented programming: Object-oriented design; encapsulation and information-hiding; separation of behaviour and implementation; classes, subclasses, and inheritance; polymorphism; class hierarchies
- Fundamental computing algorithms: simple searching and sorting algorithms (linear and binary search, selection and insertion sort)

- Fundamentals of event-driven programming
- Machine level representation of data: Bits, bytes, and words; numeric data representation and number bases; representation of character data
- Introduction to computer graphics: Using a simple graphics API
- Memory management
- Overview of programming languages: History of programming languages; brief survey of programming paradigms
- Introduction to language translation: Comparison of interpreters and compilers; language translation phases; machine-dependent and machine-independent aspects of translation

COMP SCI 1103

Algorithm Design & Data Structures

3 units - semester 2

Up to 6 hours per week

Restriction: Available to B Eng (Software Engineering) and other non-Engineering degree students only

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1102

Incompatible: COMP SCI 1203, COMP SCI 2004

Assessment: Written exam, assignments

Builds on the foundation provided by the COMP SCI 1101-1102 sequence to introduce the fundamental concepts of data structures and the algorithms that proceed from them, and aspects of software engineering. Topics include recursion, the underlying philosophy of object-oriented programming, fundamental data structures (including stacks, queues, linked lists, hash tables, and trees), the basics of algorithmic analysis, and an introduction to the principles of language translation.

- Review of elementary programming concepts
- Fundamental data structures: Stacks; queues; linked lists
- Object-oriented programming: Object-oriented design; encapsulation and information hiding; classes; separation of behavior and implementation; class hierarchies; inheritance; polymorphism
- Fundamental computing algorithms: O(N log N) sorting algorithms;
- Recursion: The concept of recursion; recursive mathematical functions; simple recursive procedures; divide-and-conquer strategies; recursive backtracking; implementation of recursion
- Basic algorithmic analysis: Asymptotic analysis of upper and average complexity bounds; identifying differences among best, average, and worst case behaviors; big "O," little "o," omega, and theta notation;
- Algorithmic strategies: Brute-force algorithms; greedy algorithms; divide-and-conquer; backtracking; branch-and-bound; heuristics; pattern matching and string/text algorithms; numerical approximation algorithms
- Overview of programming languages: Programming paradigms
- Software engineering: Software validation; testing fundamentals, including test plan creation and test case generation; object-oriented testing
- Software evolution: Software maintenance; characteristics of maintainable software; reengineering; legacy systems; software reuse

COMP SCI 1201

Introduction to Programming for Engineers

3 units - semester 1 or semester 2

Up to 6 hours per week

Restriction: Not suitable for BCompSc, BCompGr or BEng(Software Engineering) students

Available for Non-Award Study

Incompatible: APP MATHS 1000, APP MATHS 2005, APP MATHS 2106, CHEM ENG 1002, CHEM ENG 1008, COMP SCI 1012, COMP SCI 1101, ENG 2002, MECH ENG 1100, MECH ENG 1101, MECH ENG 1102, MECH ENG 1103, MECH ENG 1104, MECH ENG 1105

Assessment: Written exam, assignments

Introduces the fundamental concepts of procedural programming. Topics include data types, control structures, functions, arrays, files, and the mechanics of running, testing, and debugging. This course covers introductory programming and problem solving in MATLAB and C or Fortran.

- Algorithms and problem-solving: Problem-solving strategies; the role of algorithms in the problem-solving process; implementation strategies for algorithms; debugging strategies; the concept and properties of algorithms
- Fundamental programming constructs: Syntax and semantics of a higher-level language; variables, types, expressions, and assignment; simple I/O; conditional and iterative control structures; functions and parameter passing; structured decomposition
- Fundamental data structures: Primitive types; arrays; records; strings and string processing
- Software development methodology: Fundamental design concepts and principles; testing and debugging strategies; test-case design (black box testing and requirements testing); unit testing; programming environments

COMP SCI 1202

Object-Oriented Programming E UG

3 units - semester 2

Up to 6 hours per week

Restriction: Not suitable for BCompSc, BCompGr or BEng(Software Engineering) students

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1201

Incompatible: COMP SCI 1009, COMP SCI 1102

Assessment: Written exam, assignments

Introduces the concepts of object-oriented programming to students with a background in the procedural paradigm. The course begins with a review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting techniques, and an introduction to software engineering issues.

- Review of control structures, functions, and primitive data types
- Object-oriented programming: Object-oriented design; encapsulation and information-hiding; separation of behavior and implementation; classes, subclasses, and inheritance; polymorphism; class hierarchies
- Fundamental computing algorithms: simple searching and sorting algorithms (linear and binary search, selection and insertion sort)
- Fundamentals of event-driven programming
- Machine level representation of data: Bits, bytes, and words; numeric data representation and number bases; representation of character data
- Memory management

- Overview of programming languages: History of programming languages; brief survey of programming paradigms
- Introduction to language translation: Comparison of interpreters and compilers; language translation phases; machine-dependent and machine-independent aspects of translation

COMP SCI 1203

Algorithm Design & Data Structures for Engineers

3 units - not offered in 2011

Up to 6 hours per week

Restriction: Not suitable for BCompSc, BCompGr or BEng(Software Engineering) students

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1202

Incompatible: COMP SCI 1103, COMP SCI 2004

Builds on the foundation provided by the COMP SCI 1201-1202 sequence to introduce the fundamental concepts of data structures and the algorithms that proceed from them, and aspects of software engineering. Topics include recursion, the underlying philosophy of object-oriented programming, fundamental data structures (including stacks, queues, linked lists, hash tables, and trees), the basics of algorithmic analysis, and an introduction to the principles of language translation.

- Review of elementary programming concepts
- Fundamental data structures: Stacks; queues; linked lists
- Object-oriented programming: Object-oriented design; encapsulation and information hiding; classes; separation of behavior and implementation; class hierarchies; inheritance; polymorphism
- Fundamental computing algorithms: O(N log N) sorting algorithms;
- Recursion: The concept of recursion; recursive mathematical functions; simple recursive procedures; divide-and-conquer strategies; recursive backtracking; implementation of recursion
- Basic algorithmic analysis: Asymptotic analysis of upper and average complexity bounds; identifying differences among best, average, and worst case behaviors; big "O," little "o," omega, and theta notation;
- Algorithmic strategies: Brute-force algorithms; greedy algorithms; divide-and-conquer; backtracking; branch-and-bound; heuristics; pattern matching and string/text algorithms; numerical approximation algorithms
- Overview of programming languages: Programming paradigms
- Software engineering: Software validation; testing fundamentals, including test plan creation and test case generation; object-oriented testing
- Software evolution: Software maintenance; characteristics of maintainable software; reengineering; legacy systems; software reuse

COMP SCI 2000

Computer Systems

3 units - semester 1 or semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: MATHS1012 or MATHS 1008; COMP SCI 2004 should be studied prior to or concurrently with this course

Assessment: written exam, assignments

Information storage representation, Memory organisation and hierarchy, Processor fundamentals, assembler programming, assembler operation, subroutine calling mechanisms, linking/loading, Input-output and device controllers requirements for supporting an operating system and device drivers.

COMP SCI 2002

Database and Information Systems

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: Mathematics, as in MATHS 1012 or MATHS 1008

Assessment: written exam, assignments

Topics covered include: Data Models: E-R Model, relational model, SQL;

Security and Integrity: Authorisation and views, constraints, normalisation;

Database Connection: Java Database Connectivity, Web databases using PHP;

Storage and Access: File organisation, indexing, query processing, optimisation;

Transactions, Concurrency and Recovery: Transactions, ACID properties, locks, deadlock, logging, shadow paging.

COMP SCI 2004

Data Structures and Algorithms

3 units - semester 1 or semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: Mathematics as in MATHS 1012 or MATHS 1008

Assessment: practical exams and/or written exam, assignments

Program development techniques including basic ideas of correctness and proof; Recursion. Approaches to Problem Solving. Notion of abstract data type, representation of lists, stacks, queues, sets, trees and hash tables. Notions of complexity and analysis; Choosing data structures

COMP SCI 2005

Systems Programming in C and C++

3 units - semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2004

Assessment: written exam, assignments

Introduction to C; syntax of functions and basic structure, keywords, expressions. Variables; scoping and lifetime, structures, arrays and pointers. Run time stack; function invocation, parameter passing, passing arrays. Memory; segmentation, dynamic allocation, leaks and buffer over-runs. Compilation process; preprocessor, compiling object code, static and dynamic linking. File I/O; streams, reading and writing files. UNIX tools; design philosophy, combining programs using pipes and I/O redirection. Profiling tools, binary tools, debugging. Basic shell scripting. Build tools. Compiler flags. C++; class syntax, C++ object model, inheritance, virtual and pure virtual functions. Copy and assignment semantics and their

consequences. Overloading operators. I/O using the C++ STL. Templates; syntax, use with the STL, default types, run time performance.

COMP SCI 2006

Introduction to Software Engineering

3 units - semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2004 & MATHS 1012 or MATHS 1008

Assessment: written exam, assignments

Design: software design, UML notation, static models - identifying classes and associations, dynamic models - identifying states, events, transitions, use cases, mapping designs into code. Specification: the scope, role and styles of software specification. Testing: modes of testing, organising test suites. Human issues: managing object-oriented projects, ethics, professional practice.

COMP SCI 3001

Computer Networks and Applications

3 units - semester 1

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2004

Assessment: written exam, assignments

Introduction to networks and digital communications with a focus on Internet protocols: Application layer architectures (client/server, peer-to-peer) and protocols (HTTP-web, SMTP-mail, etc), Transport layer operation: (reliable transport, congestion and flow control, UDP, TCP); Network layer operation - (routing, addressing, IPv4 and IPv6), Data Link layer operation (error detection/correction, access control, Ethernet, 802.11, PPP), Layer 2/3 protocols (ATM and MPLS); selected current topics such as: security, multimedia protocols, Quality of Service, mobility, wireless networking, emerging protocols, network management

COMP SCI 3002

Programming Techniques

3 units - semester 1

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2004 & COMP SCI 2000

Assessment: written exam, assignments

Program development: methods of specification, design, implementations, testing and debugging, case studies, Graphs: construction, traversal, topological sorting, applications. Sorting and searching: internal and external algorithms, correctness and complexity analysis.

COMP SCI 3004

Operating Systems

3 units - semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007 and basic knowledge of C programming as in COMP SCI 2005

Assumed Knowledge: COMP SCI 2000 & COMP SCI 2004

Assessment: written exam, assignments

OS purposes: resource management and the extended virtual computer; historical development. Processes: critical sections and mutual exclusion, semaphores, monitors, classical problems, deadlock; process scheduling. Input and Output: hardware and software control. Memory management: multi-programming; swapping; virtual memory, paging and symbolic segmentation; File System: operations, implementation, performance. Protection mechanisms: protection domains, access lists, capability systems, principle of minimum privilege.

COMP SCI 3005

Computer Architecture

3 units - semester 1

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2000 & COMP SCI 2004

Assessment: written exam, assignments

Fundamentals of computer design; quantifying cost and performance; instruction set architecture; program behaviour and measurement of instruction set use; processor datapaths and control; pipelining, handling pipeline hazards; memory hierarchies and performance; I/O devices, controllers and drivers; I/O and system performance.

COMP SCI 3006

Software Engineering and Project

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 3002 & COMP SCI 2004

Assessment: written exam, compulsory group project

Within the context of a semester-long, group-based software engineering project, this course provides an introduction to the production of high quality software solutions to large tasks. Among the topics covered in this course are the following: models of the software life-cycle, requirements analysis and specification, program design techniques and paradigms, software specification techniques, configuration management and version control, quality assurance, integration and testing, project management, risk analysis, case study of ethical considerations in Software Engineering.

COMP SCI 3007

Artificial Intelligence

3 units - semester 1

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2004

Assessment: written exam, assignments

This is an introductory course on Artificial Intelligence. The topics may include: AI methodology and fundamentals; intelligent agents; search algorithms; game playing; supervised and unsupervised learning; decision tree learning; neural networks; nearest neighbour

methods; dimensionality reduction; clustering; kernel machines; support vector machines; uncertainty and probability theory; probabilistic reasoning in AI; Bayesian networks; statistical learning; fuzzy logic. Several assignments will be given to enable the student to gain practical experience in using these techniques.

COMP SCI 3009

Advanced Programming Paradigms

3 units - semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2004

Assessment: written exam, assignments

A selection of topics from the following: Fundamental models of computation, illustrated by the lambda calculus. Different approaches to programming: functional and logic paradigms. Fundamental concepts of programming languages, including abstraction, binding, parameter passing, scope, control abstractions. Programming models expressed via Scheme: substitution model; map/reduce programming; environment model; object oriented model; a compositional programming model. Introduction to parallel computing: data parallelism, Java threads, and relationship to distributed computing. Examples in application: map/reduce programming in Google and with Hadoop; flow-oriented programming for composition of web-services. Cloud computing platforms and programming models

COMP SCI 3012

Distributed Systems

3 units - semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 or COMP SCI 1007

Assumed Knowledge: COMP SCI 2000, COMP SCI 2004 & COMP SCI 3001; exposure to SQL programming (e.g. COMP SCI 2002)

Assessment: written exam, assignments

A selection of topics from the following: the challenges faced in constructing client/server software: partial system failures, multiple address spaces, absence of a single clock, latency of communication, heterogeneity, absence of a trusted operating system, system management, binding and naming. Techniques for meeting these challenges: RPC and middleware, naming and directory services, distributed transaction processing, 'thin' clients, data replication, cryptographic security, mobile code. Introduction to Java RMI.

COMP SCI 3013

Event Driven Computing

3 units - semester 2

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 & COMP SCI 1007

Assumed Knowledge: COMP SCI 2004 & COMP SCI 2006

Assessment: written exam, assignments

Event driven paradigm: Finite State Automata, their behaviour and implementation. Correspondence with regular expressions. Examples of embedded systems. Introduction to interconnected state machines, Petri Nets, and concurrency. Concepts of state-space and relationship to testing.

Building Graphical User Interfaces: model view controller paradigm. Building GUIs with the Java Swing library. Ease of use and human-computer interaction issues. Introduction to design patterns for managing complexity in large systems

Practical projects cover the use of FSAs for control logic and GUI design.

COMP SCI 3014

Computer Graphics

3 units - semester 1

Up to 2.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1009 & COMP SCI 1007

Assumed Knowledge: MATHS 1012 & COMP SCI 2005

Assessment: written exam, assignments

Selected topics from:Light and the human visual system. Colour. Images, quantisation and sampling. Image manipulations. Raster graphics. Coordinate systems and transformations. The viewing frustum. The graphics pipeline and toolkits. Clipping and culling. Visibility. Lighting and shadows. Transparency and blending. Texture mapping. Local shading models. Environment mapping techniques. Multi-pass rendering. Shaders. Animation and particles. Level of detail. Scene graphs and implementation efficiency.

COMP SCI 3016

Computational Cognitive Science

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): COMP SCI 1007 & COMP SCI 1009, APP MTH 1000 or COMP SCI 1012

Assumed Knowledge: Basic probability as taught in MATHS 2103 & some familiarity with programming in MATLAB

Assessment: Written exam, assignments

This course provides an introduction to computational theories of human cognition. We use formal models from artificial intelligence and mathematical psychology to consider fundamental issues in human knowledge representation, inductive reasoning, learning, decision-making and language acquisition. What kind of informational structures describe the organisation of human knowledge, and what kinds of inferences do they license? How do humans make choices given time constraints, computational limitations, and external costs imposed by the world? What kinds of innate knowledge (if any) must people have? And how can formal models of human cognition inform our understanding of the design of intelligent machines? Representative modelling techniques include stochastic processes, Bayesian models, formal grammars, and random graph models.

COMP SCI 3017

Software Engineering Group Project 1 A

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE Software Engineering students only

Incompatible: COMP SCI 3015

Assessment: Written exam and compulsory group project

This course in software engineering provides an introduction to the production of high quality software solutions to large tasks. Among the topics covered in this course are the following: models of the software life-cycle, requirements analysis and specification, program design techniques and paradigms, software specification

techniques, configuration management and version control, quality assurance, integration and testing, project management, risk analysis, case study of ethical considerations in Software Engineering. Students will undertake a small group-based project, introducing the students to the practice of the software development methodologies and techniques described in lectures.

COMP SCI 3018

Software Engineering Group Project 1 B

3 units - semester 2

Up to 1 hour per week

Restriction: Available to BE Software Engineering students only

Pre-Requisite(s): COMP SCI 3017

Incompatible: COMP SCI 3015

Assessment: Compulsory group project, research report

Students will undertake a medium-sized group project that will further expose students to the practice of software development methodologies and techniques throughout various stages in the development lifecycle.

Regular weekly meetings will be held with teaching staff, in which students will be expected to: report on progress; demonstrate software prototypes; and present their software development methodologies and artefacts.

Students will write a research report of approximately 5000 words on some aspect of current software engineering practice.

COMP SCI 4000

Software Architecture

3 units - semester 2

Up to 2 hours per week

Available for Non-Award Study

Assessment: Exam and/or assignments

Topics selected from: common software architectures; design patterns; middleware; product-line architectures; architecture modelling and views; architecture description languages and systems; Model Driven Development; Architectural Analysis; Case Studies.

COMP SCI 4003A

Software Engineering Group Project 2 Pt A

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE Software Engineering students only

Incompatible: COMP SCI 4001, COMP SCI 4002, COMP SCI 4011

Assessment: Compulsory group project

Students will undertake a year long industry-based group project. The project will be conducted in groups of 3-5 students in collaboration with an industry partner. Students will have regular meetings with teaching staff and industry stakeholders in which they will be expected to: elicit requirements; conduct software demonstrations; and report on progress. Students will be expected to apply and demonstrate the use of rigorous software development methodologies and techniques in their project, including the areas of: configuration management; project planning; requirements capture and tracking; software quality management; and software verification and validation. Students will also be expected to assess and where appropriate, apply software tools to support rigorous software development.

COMP SCI 4003B

Software Engineering Group Project 2 Pt B

3 units - semester 2

Restriction: Available to BE Software Engineering students only

Pre-Requisite(s): COMP SCI 4003A

Incompatible: COMP SCI 4001, COMP SCI 4002, COMP SCI 4011

Assessment: Compulsory group project

Students will continue the project commenced in COMP SCI 4003A.

COMP SCI 4005

Adaptive Business Intelligence

3 units - semester 1

Up to 2 hours per week

Available for Non-Award Study

Assumed Knowledge: Java, program design, discrete Mathematics

Assessment: written exam and/or assignments

Adaptive Business Intelligence (ABI) is the discipline of using prediction and optimization techniques to build self-learning "decisioning" systems. ABI fundamentals: philosophy of ABI, methodology, techniques, adaptive real-life software, and applications of ABI systems. Optimization techniques: Local Hill-Climber, Stochastic Hill-Climber, Simulated Annealing, Tabu Search, Evolutionary Algorithm, Constraint Handling, Multi-Objective Optimization, Adaptability. Prediction techniques: Data Preparation, Fuzzy Logic, Neural Networks, Genetic Programming, Ant Systems, Swarm Intelligence, Agent-Based Modelling, Co-Evolution, Adaptability. Hybrid Systems: Hybrid Prediction Systems, Hybrid Optimization Systems, Adaptability. Real-life ABI case studies.

COMP SCI 4011A

Software Engineering Honours Project Pt A

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE Software Engineering students only

Incompatible: COMP SCI 4001, COMP SCI 4002, COMP SCI 4003

Assessment: Compulsory group project and/or research project

Students will undertake a year long industry-based group project. The project will be conducted in groups of 3-5 students in collaboration with an industry partner. Students will have regular meetings with teaching staff and industry stakeholders in which they will be expected to: elicit requirements; conduct software demonstrations; and report on progress. Students will be expected to apply and demonstrate the use of rigorous software development methodologies and techniques in their project, including the areas of: configuration management; project planning; requirements capture and tracking; software quality management; and software verification and validation. Students will also be expected to assess and where appropriate, apply software tools to support rigorous software development.

Students contemplating a higher degree by research pathway may undertake an alternative research based project.

COMP SCI 4011B

Software Engineering Honours Project Pt B

3 units - semester 2

Pre-Requisite(s): COMP SCI 4011A

Incompatible: COMP SCI 4001, COMP SCI 4002, COMP SCI 4003

Assessment: Compulsory group project and/or research project

Students will continue the project commenced in COMP SCI 4011A.

COMP SCI 4022

Computer Vision

3 units - semester 2

Up to 2 hours per week

Available for Non-Award Study

Assessment: Exams and/or assignments

Over the last 40 years, researchers in artificial intelligence have endeavoured to develop computers with the capacity to "see" the world around them. This course aims to convey the nature of some of the fundamental problems in vision, and to explain a variety of techniques used to overcome them. Vision is a rapidly evolving area of computer science, and new and emerging approaches to these problems are discussed along with more "classical" techniques. Various vision problems are considered, including: feature detection in images, e.g. edge detection, and the accumulation of edge data to form lines; recovery of 3D shape from images, e.g. the use of a stereo image pair to derive 3D surface information; forming image mosaics; video surveillance techniques, e.g. tracking objects in video; motion detection in video images, e.g. counting number of moving objects in a video; recognising and classifying objects in images, e.g. searching a video for a particular object. Several assignments will be given to enable the student to gain practical experience in tackling some of these problems.

COMP SCI 4023

Software Process Improvement

3 units - semester 2

Up to 5 hours per week

Available for Non-Award Study

Assessment: exam and/or assignments

The course introduces students to elements of the Software Engineering Institute's Personal Software Process, PSP. The PSP is introduced in increasing levels of sophistication with the essential elements illustrated by programming assignments and report writing.

COMP SCI 4041

Language Translators

3 units - semester 1

Up to 2 hours per week

Available for Non-Award Study

Incompatible: COMP SCI 3011

Assessment: Exams and/or assignments

The structure of compilers: lexical analysis, syntax analysis (top-down and bottom-up techniques), the handling of context-sensitive and context-free errors, type checking and code generation. BNF languages and grammars. This course is closely coupled with the writing of a large, compulsory programming project

COMP SCI 4044

Computer System Security

3 units - semester 1

Up to 2 hours per week

Available for Non-Award Study

Assumed Knowledge: COMP SCI 3005, COMP SCI 3004, COMP SCI 3001. Additionally, some basic understanding of parsing and parsers and Computer Systems is an advantage. No detailed knowledge of advanced cryptographic systems is required.

Assessment: Exams and/or assignments

This course provides an introduction to computer system security at all levels, with an emphasis on engineering secure systems. The course includes material drawn from: computer security models, hardware systems, operating system mechanisms and policy, network security, and application security. The course will also cover some of the current security issues. One or more current security issues discussed will be used as a theme when exploring some of the topics covered. Topics covered include the following: Introduction to Computer Security: Threats, vulnerabilities, controls; risk; cost; method, opportunity, motive; technical, administrative, physical controls; prevention, detection, deterrence. Basic cryptography terms, symmetric and asymmetric cyphers; Cryptographic protocols: digital signatures, key exchange, certificates, cryptographic hash functions. Security Models: Introduction to Military Security; Bell La Padula models, BIPA. Security in programs: Flaws - Malicious code: viruses, Trojan horses, worms; Program flaws: buffer overflows, time-of-check to time-of-use flaws, incomplete mediation. Defenses - Software development controls, Testing techniques. Security in Operating Systems: Memory, time, file, object protection requirements and techniques; Protection in contemporary operating systems. Identification and authentication: Identification goals; Authentication requirements; human authentication, machine authentication, authentication technologies. Trusted operating systems: Assurance; trust; Design principles; Evaluation criteria; Evaluation process. Network security: Threats - Network technology; eavesdropping, spoofing, modification, denial of service attacks. Controls - architectural controls; cryptographic controls; technological controls; administrative and physical controls; overlapping controls. Technologies - Firewalls; Intrusion detection systems; Monitoring systems; Virtual private networking; Remote authentication systems. Management of security: Security policies; Risk analysis; Physical threats and controls.

COMP SCI 4045

Distributed High Performance Computing

3 units - semester 2

Up to 2 hrs per week

Available for Non-Award Study

Assumed Knowledge: At least one of C, Fortran or Java, & code presented in any of these languages; COMP SCI 3009, COMP SCI 3012

Assessment: Written exam and/or assignments

The course gives an overview of current technologies for programming and using parallel and distributed high-performance computing systems. The course provides material in parallel computing, cluster computing, distributed computing, grid and cloud computing technologies, including an introduction to web services and cloud platforms. Some background is given on architectures for high performance computing, but the emphasis is on what the software developer needs to know to exploit high performance distributed computing architectures. The course has a strongly applied outlook.

COMP SCI 4054

High Integrity Software Engineering

3 units - semester 1

Up to 2 hours per week

Available for Non-Award Study

Assessment: Exams and assignments

This course introduces students to high-integrity software engineering, with a focus on the development of safety-critical software. Lectures will cover hazard analysis, risk analysis, safety-critical software, formal methods, safety cases and safety management. Students will apply a variety of practical techniques in assignments.

COMP SCI 4077

System Modelling and Simulation

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Assessment: Exams and/or assignments

This course concerns techniques for the modelling and simulation of complex systems using a variety of methods and software tools. Students are introduced to the package Matlab and are taken through a study of the techniques used in sophisticated modelling packages to solve common engineering problems.

The Matlab programming language is used extensively and students learn to program their own solutions for these common engineering problems. In addition to studying the equations for these models and their solutions, students study the stability, accuracy and reliability of the solution methods.

COMP SCI 4091

Commercialising IT Research UG

3 units - summer semester or semester 1 or semester 2

Up to 2 hours per week

Available for Non-Award Study

Assessment: Written exams and/or assignments

This course covers the process of transforming IT research into commercial products for the marketplace. Topics include: Protection of intellectual property (IP) - patents, trade secrets, copyrights. Creation of business plans for IT companies and products. Choosing a company structure, starting up, and avoiding early pitfalls. Understanding business ethics. Building out a management team and board. Raising capital - angel investors, venture capital, debt financing. Marketing - branding, positioning, media outlets, analysts. Sales - IP licensing, support infrastructure, joint ventures, partnerships. Differences between US and Australian commercialisation environments.

COMP SCI 4092

Mobile and Wireless Networks UG

3 units - not offered in 2011

Up to 2 hours per week

Available for Non-Award Study

Assumed Knowledge: COMP SCI 3001

Assessment: Written exam and/or assignments

This course examines the characteristics of mobile and wireless networks and the impact of these characteristics on the development of software and supporting protocols. Topics covered include: mobile and wireless application design and development environments, middleware support, protocol requirements for ad-hoc and sensor networks, wireless & mobile security vulnerabilities and standards, supporting reliable communication in lossy and intermittently connected networks; challenges and architectures for wireless mobility - 4G networks, Wi-Fi, Wi-Max, Bluetooth, Mobile IP, convergence of voice and data networks.

COMP SCI 4094

Distributed Databases and Data Mining

3 units - not offered in 2011

Up to 2 hours per week

Available for Non-Award Study

Assumed Knowledge: Knowledge of database systems as taught in COMP SCI 2002

Assessment: exam and/or assignments

Topics covered in this course include: Distributed database system architecture, Distributed database system design, Distributed query processing and optimisation, Distributed transaction management, Data warehousing and OLAP technology, Association analysis, Classification and prediction, Cluster analysis, Mining complex types of data.

COMP SCI 4095

Evolutionary Computation

3 units - semester 2

Up to 2 hours per week

Available for Non-Award Study

Assumed Knowledge: COMP SCI 2004

Assessment: assignments

History of evolutionary computation; major areas: genetic algorithms, evolution strategies, evolution programming, genetic programming, classifier systems; constraint handling; multi-objective cases; dynamic environments; parallel implementations; coevolutionary systems; parameter control; hybrid approaches; commercial applications.

COMP SCI 4999A/B

Honours Computer Science Part 1 & 2

24 units - full year

Pre-Requisite(s): Degree & major in Comp.Sc; Passes in Level II & III courses in Maths & Comp. Sciences approved by Head of School - students with adifferent background should apply to Head of School

Assumed Knowledge: Level II & III Computer Science courses depending on composition of Honours program

Assessment: performance in six lecture courses 60%, major project 40%

Students intending to enrol in Honours Computer Science are advised to consult the Head of the School of Computer Science, preferably before enrolling for Level III courses

The course will be determined from year to year and will consist mostly of lectures given in the School of Computer Science. Other courses may be included, subject to the approval of the Head of the School. Students will be required to undertake a major computing project, under the guidance of a supervisor.

Electrical and Electronic Engineering

ELEC ENG 1009

Electrical & Electronic Engineering 1A

3 units - semester 1 or semester 2

Up to 6.5 hours per week

Available for Non-Award Study

Assessment: assignments, exams, performance in laboratory

Basic Circuits/DC Analysis: electrical quantities, components and sources, circuit analysis laws; Kirchhoff laws, series/parallel circuits, voltage/current divider, superposition, Thevenin theorem; controlled sources. Introduction to Electronics: electrical devices (diodes,

transistors) and applications. Diodes, DC power supplies, transistors and op-amps. Introduction to Electrical Machines: introduction to magnetic circuits, transformers and DC and AC machines. Introduction to Digital Electronics: Boolean numbers and algebra, combinational components. Microcontroller Principles: microprocessor basics, interfacing and sensors. Digital Workshop: safety and basic skills; Design Project; electronic die, power supply, oscillator, logic gates, flip-flops and counters, an electrical machines lab session.

ELEC ENG 1010

Electrical & Electronic Engineering 1B

3 units - semester 1 or semester 2

Up to 6.5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1009

Assessment: assignments, exams, performance in laboratory

AC Analysis: sinusoidal AC signal characteristics; review of complex numbers; phasor representation and analysis; power energy. Mesh and Nodal analysis: Signals and Communication: resonance of RLC circuits; filters and frequency response; amplitude and frequency modulation concepts. Digital Electronics: sequential logic, advanced methods. Communications Skills and Professional Engineering: basic verbal skills including presentation; basic written skills for documents such as experimental reports; introduction to EEE degree programs. Analog Workshop: safety and basic skills; regulated power supply. Simple audio amplifier, hee-haw siren, preamplifier, crystal set, system project: AM radio

ELEC ENG 2007

Signals and Systems II

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Avionics &El systems), BE(Computer Sys), BE(El &El), BE(Telecom) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1010

Assessment: assignments, written exam

Continuous signals and systems: block diagrams, linearity, causality, stability and time-invariance, linear time-invariant (LTI) systems, impulse response; convolution sum & integral; convolution & correlation

Fourier techniques in signals and systems: Fourier series and transform of signals, frequency response of continuous time LTI circuits and systems, Fourier transforms and continuous spectra, applications, correlation and power spectrum

Communication Signals and Systems Introduction: signal and carrier; bandwidth and spectrum allocation; modulation schemes: AM, FM and PM; transmitters and receivers: filters, down- and up-conversion, mixers; modulators and demodulators

Analogue Filters: filters and filtering; analog filter design; low pass prototypes (Butterworth, Chebyshev, All Pass, Elliptic); filter design and transformations - (low, high, band); realisation of passive filter circuits; scattering parameters, lumped LC circuits, admittance parameters; active filters 1st and 2nd order transfer functions

ELEC ENG 2008

Electronics II

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Avionics &El systems), BE(Computer Sys), BE(El &El), BE(Telecom) & associated double degree students only

Available for Non-Award Study

Co-Requisite(s): ELEC ENG 2011

Assumed Knowledge: ELEC ENG 1010

Assessment: assignments, written exam

Devices and Basic Circuits. Diodes: ideal, characteristics, operation, analysis, small-signal model and application, reverse breakdown (Zener), rectifier. BJTs: structure, operation, npn/pnp, graphical characteristics, DC analysis, amplifiers, small-signal model, graphical analysis, biasing, single-stage amplifiers. FETs: structure, operation, I-V characteristics, enhancement/depletion, biasing, single-stage amplifiers. Analog Circuits: BJT differential pair, small-signal analysis, non-ideal behaviour, biasing, current mirrors, differential and multi-stage amplifiers, output stages classification (A, B, AB) biasing. Altium: application to rectifier, BJT, FET, inverter analysis. Intro. to Digital Circuits: electronics in digital circuits, FET inverter: linear and non-linear transfer function, slew-rate, delay time, fan-out, extension to more complex digital gates

ELEC ENG 2009

Engineering Electromagnetics

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Avionics &El systems), BE(Computer Sys), BE(El &El), BE(Telecom) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1010, APP MTH 2201, PHYSICS 1100 & PHYSICS 1200

Assessment: assignments, written exam

Statics: electrostatics (Coulomb/Gauss laws, electric scalar etc); magnetostatics (fields in vacuum, magnetic material, circuits)

Electromagnetic Induction: time-varying electromagnetic fields, machines and transformers (DC gen/motor, ideal transformer, 3ph induction motor)

Maxwell's Equations and Electromagnetic Waves: Maxwell's equations, transmission lines, skin effect, uniform plane waves, reflection and refraction

Practical Aspects: antennas (transmit/receive, dipole, directivity) and applications (attenuation, propagation)

ELEC ENG 2011

Circuit Analysis

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Avionics &El systems), BE(Computer Sys), BE(El &El), BE(Telecom) & associated double degree students only

Available for Non-Award Study

Pre-Requisite(s): ELEC ENG 1009 & ELEC ENG 1010

Assessment: On-line tests, quizzes, practicals, Final exam

Circuit Fundamentals. Revision of circuit elements and analysis methods including symbols, passive/active conventions, dependent and independent sources, KVL, KCL, mesh/nodal.

Operational Amplifiers. Analysis of ideal amplifier for inverting, non-inverting, voltage follower configurations. Non-ideal effects : finite gain, bandwidth, slew rate and DC offsets.

Time-Domain Techniques. Capacitors and inductors: energy storage, integration/differentiation of voltage and current, differential equations and numerical simulation. Altium introduction. First-order RC and RL circuits : transient response, time-constant, calculation of response using initial/final values and time-constant. Second-order RLC circuits : overview of analytical solution, effect of damping and natural frequency on time response.

Frequency-Domain Techniques. Phasors: phasor quantities, complex impedance, AC steady-state circuit analysis (lagging and leading). Laplace Transforms: uni- and bi-lateral transform, transfer functions, partial fractions for simple/repeated poles, initial/final value theorem. Bode plots: transfer functions, poles and zeros, drawing first and second-order functions. RLC filter types: low, high, band-pass.

ELEC ENG 2012

Sustainable Energy Project

3 units - semester 2

Up to 2 hours per week, plus 120 hours practical

Restriction: Available to BE(SustainableEnergy)(Chemical) students only

Assumed Knowledge: ELEC ENG 1009, ELEC ENG 1010

Assessment: Project work performance, Written report, Seminar presentation

This course aims to utilise standard electrical engineering calculations and preliminary electrical design knowledge for renewable energy systems. After some preliminary lectures, the students will participate in engineering design projects which will involve modeling, simulation and testing of a selected renewable energy source and associated control circuit topologies. The students will work in groups and gain an depth understanding of practical issues related to renewable energy systems. They will perform a technical review of the concept covered in their project, and will produce a technical report including design approach, results and conclusions. There will also be opportunity to present their work to their peers. The course assessment will be primarily based on the overall project performance as well as the technical report and presentation skills.

ELEC ENG 3018

RF Engineering III

3 units - semester 1

Up to 4.5 hours per week

Restriction: Available to BE(Electrical&Electronic) students only

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2008, ELEC ENG 2009

Assessment: written exam, tests and practicals

Basic concepts of electromagnetic radiation, propagation and antennas. Elementary transmission line theory. Radio Frequency systems and performance constraints. Tuned circuits and matching. High frequency transistor models. Tuned and broadband amplifiers. Oscillators and mixers. Modulation and demodulation. Introduction to phase locked loops. Miscellaneous analogue circuits.

ELEC ENG 3021

Electric Energy Systems

3 units - semester 1

Up to 3 hours per week

Restriction: Available to BE(Electrical&Electronic) students only

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1009

Assessment: written exam, assignments, practicals

Electric energy systems overview: Electric loads and energy pricing. Electric transmission and distribution networks. Conventional energy generation systems, sustainable/renewable energy sources. Energy storage. Economics, management and sustainability.

Modelling and analysis of electric energy systems: single-phase and three-phase circuits (real and reactive power, per-unit systems). Electromechanical energy conversion (construction, modelling and characteristics of induction and synchronous machines). Electric energy transmission and distribution (modelling of transmission lines, system analysis, control of voltage, power and frequency).

ELEC ENG 3024

Project Management for Electrical Engineering

3 units - semester 2

Up to 6 hours per week

Restriction: Available to BE(Electrical&Electronic) students only

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2007, ELEC ENG 2008

Assessment: written exam, assignments, project work

Principles of project management as applied to engineering systems; leadership and team skills; group project work to exercise planning organisational and communication skills

ELEC ENG 3026

Engineering Systems: Avionics

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2007, ELEC ENG 2008

Assessment: Examination and assignments

Avionic Systems: Aircraft as systems - overview of major subsystems; Aircraft as subsystems - overview of air transport system and major subsystems; Aircraft subsystems: Principles of flight; Flight control system; Flight management system; Navigation Control and Guidance system; Landing aids; Surveillance; Collision avoidance System; In flight entertainment system; Regulatory framework and standards

ELEC ENG 3027

Control III

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2007, MATH 2201 & MATH 2202

Assessment: Written exam, homework exercises, practicals

Transfer functions; stability; dynamic and steady-state performance; root locus diagrams; Bode and Nyquist plots; cascade compensation using root locus and frequency response techniques; minor-loop feedback. Introduction to state-space modelling and analysis. Analysis and design of digital control systems.

ELEC ENG 3028

Digital Systems

3 units - semester 2

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1009, ELEC ENG 1010, ELEC ENG 2008

Assessment: practical exercises and collaborative design exercises, tutorial preparation and a final examination

Building Digital Systems; Combinatorial Logic Design; Sequential Logic Design; Digital Subsystems and Interfaces; Digital Systems Architecture; Beneath the Digital Abstraction

ELEC ENG 3029

Project Management for Sustainable Energy

3 units - semester 2

Up to 3 hours per week

Assumed Knowledge: ELEC ENG 1009 & ELEC ENG 1010, ELEC ENG 3021

Assessment: Team project, written exam, assignments

Teamwork; Project lifecycle; Project planning; Project monitoring and evaluation; Completion of a team project in electrical sustainable energy engineering involving teamwork, problem solving, and use of project management and engineering skills.

ELEC ENG 3031

Power Systems

3 units - semester 2

Up to 5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1009 & ELEC ENG 1010

Assessment: Quizzes and practical assignments

Transmission Line Parameters; Transmission Lines: Steady-State Operation; Power Transformers; Power Flows; Symmetrical Faults; Symmetrical Components and Unsymmetrical Faults; Power System Controls; Transient Stability

ELEC ENG 3033

Signal Processing III

3 units - semester 1

Up to 5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2007, MATHS 2201, MATHS 2202

Assessment: Examinations, Quizzes, Homeworks and Practicals

Discrete-time signals; Discrete-time LTI systems; Fourier Transforms; Digital Filtering Principles; Digital Filter Design; Statistical Signal Processing Fundamentals; Correlation functions and Covariance Matrices; Practical signal processing skills in MATLAB

ELEC ENG 3034

Telecommunications III

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2007

Assessment: examination, homework and assignment

Plain Old Telephone System; Cellular systems, including GSM and IS-95 CDMA; Principles of IP - datagram networks and routing; Principles of ATM; QoS on IP;

Audio and Voice coding; Voice over IP; GPRS and ADSL - hybrid voice/data network principles,

Satellite applications: voice telephony and navigation (GPS).

ELEC ENG 4036A

Design Project Part 1

Pre-Requisite(s): ELEC ENG 3027, ELEC ENG 3028, ELEC ENG 3033, ELEC ENG 3024 or ELEC ENG 3029

ELEC ENG 4036B

Design Project Part 2

6 units - full year

150 hours project work

Restriction: Available to BE(Electrical&Electronic) students only

Pre-Requisite(s): ELEC ENG 4036A

Assessment: performance during project work, written reports, seminar presentations

Each candidate is required to conduct investigations involving the design, development and testing of hardware and/or software. The results are presented in written report form, by seminar and, where appropriate, demonstration of the completed work.

ELEC ENG 4039A

Honours Project Part 1

Pre-Requisite(s): ELEC ENG 3027, ELEC ENG 3028, ELEC ENG 3033, ELEC ENG 3024 or ELEC ENG 3029

ELEC ENG 4039B

Honours Project Part 2

6 units - full year

150 hours project work

Restriction: Available to BE(Electrical&Electronic) students only

Pre-Requisite(s): ELEC ENG 4039A

Assessment: performance during project work, written reports, seminar presentations

Each candidate is required to conduct investigations involving theoretical surveys and the design, development and testing of hardware and/or software. The results are presented in written report form, by seminar and, where appropriate, demonstration of the completed work.

ELEC ENG 4052

Special Studies in EEE

3 units - semester 1 or semester 2

Available for Non-Award Study

Topics as specified by Head of School

ELEC ENG 4053

Digital Microelectronics

3 units - semester 1

up to 5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2008, ELEC ENG 2011, ELEC ENG 3028

Incompatible: ELEC ENG 4037

Assessment: Written exam, project work, computer labs, quizzes during semester

Introduction to fabrication processes, design rules (revisited); transistor models (revisited from third year electronics); layout issues; ASIC design flow (4 lectures). VLSI design methodology and leaf cell design (3 lectures). Performance estimation of CMOS complex gates and interconnected modules using logical effort (6

lectures). Interconnect issues, clock distribution, design margin, reliability and scaling (4 lectures). Static and dynamic CMOS logic families and adders design (7 lectures). Memory structures and operation (2 lectures). Low power design and system level consideration (3 lectures). BiCMOS, SOI and GaAs technologies (2 lectures). In addition to two quizzes (2 hours) and a major project using layout and simulation tools.

ELEC ENG 4054

Telecommunications Systems

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 3034 or ELEC ENG 4046 or equivalent

Incompatible: ELEC ENG 4046

Assessment: Examination and assignments

Third generation mobile systems: WCDMA concepts, Multi-User Detection, Antenna Array techniques, MIMO, High Speed Packet Access, Long Term Evolution, Radio Resource Management, Packet Scheduling, Core Network Evolution. Multimedia: Image and video representation and transmission, JPEG, VLBV, MBMS. Competing technologies: WiFi, WiMAX, FttX. Emerging techniques: may include MANET, Cognitive Radio.

ELEC ENG 4055

System Engineering

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: completion of at least two years of an engineering degree program

Incompatible: ELEC ENG 4050

Assessment: Project work, assignments and examination

System thinking. The principles of systems engineering. Life cycle management. System engineering process overview. Requirements management, user requirements, functional analysis, system requirements, verification, system architecture, system and subsystem design, validation and test and evaluation. Engineering review processes. System engineering tools. Through life sustainment of systems; design and operation of product-service systems. Engineering of enduring systems. Relationship to project Management.

ELEC ENG 4056

Real Time Systems IV

3 units - semester 2

up to 5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1006, COMP SCI 2000

Incompatible: ELEC ENG 3022

Assessment: assignment, written exam, homework, quiz

Time-critical computing, real-time kernels and development systems, scheduling periodic and aperiodic tasks, intertask communication and synchronisation, rate monotonic analysis, real-time message transmission in distributed local area networks.

ELEC ENG 4057

RF Engineering IV

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 3018

Incompatible: ELEC ENG 4044

Assessment: written exam, tests, laboratory exercises

Revision of transmission lines. Microstrip lines. The use of transmission lines for matching. S matrix circuit theory and amplifier design using S parameters. Introduction to propagation (reflection, refraction and diffraction). Radiation fields. Wire antennas (including loops, dipoles and monopoles). Effective area, directivity and gain. The Friis equation. Influence of environment upon antenna performance. Broadband antennas. Introduction to array antennas (including the log periodic dipole array). Aperture antennas (including patch designs).

Analogue microelectronics: Review of fabrication processes, design rules and transistor models. Layout issues; ASIC design flow; simulators and performance estimation; current sources and references; different configuration of operational and transconductance amplifiers and common mode feedback techniques.

ELEC ENG 4058

Power Quality & Condition Monitoring

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2008

Incompatible: ELEC ENG 4043

Assessment: Quizzes, semester assignments

This course will address power quality issues and condition monitoring techniques used in industrial systems. A brief overview of power systems and three-phase machines will be given, and the course will cover various issues under two major sections.

Power Quality: EMI in energy systems, types of power quality issues, regulations, standards, prevention techniques, measurements and analysis, case studies and real-time tests.

Condition Monitoring: Importance, history, types and features of faults, test methods, sensors and measurement techniques, traditional and advance diagnostic methods, case studies and real-time tests.

ELEC ENG 4059

Power Electronics and Drive Systems

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: ELEC ENG 1009 or ELEC ENG 1010, ELEC ENG 2008

Incompatible: ELEC ENG 4042, ELEC ENG 3025

Assessment: Written exam and quizzes

Characteristics of power electronic devices. Losses and thermal design. Classes of power converters. Voltage and current source converters. Hard and soft-switching and resonant circuits. Power supplies (uninterruptible, switchmode)

Advanced energy-efficient motor drives: review of motor theory, power electronic control principles, vector and servo drives (stepper, DC, induction, brushless PM and switched-reluctance). Modulation

methods. Matrix Converter. Theory Motor and drive selection and application. System design, implementation and control. Computer interfacing, network communication.

ELEC ENG 4060

Introduction to Electronic Defence Systems

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 3018, ELEC ENG 2007, ELEC ENG 2009

Incompatible: ELEC ENG 4051

Assessment: Tests, computer-based simulation, assignment

This subject introduces student to the basic operating principles of electronic defence systems such as radar, electronic warfare and satellite navigation systems. Content includes: radar fundamentals, radar measurements, imaging radar systems, current and future radars; principles of electronic warfare, electronic support, electronic protection, current and future electronic warfare systems; principles of global navigation satellite systems, global positioning systems, GNSS applications; other electronic systems. Introduction to system architectures, standards, system integration, validation and test.

ELEC ENG 4061

Image Processing

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 3033, COMPSCI 1008 COMPSCI 1009

Assessment: Examination and assignments

Overview of imaging sensors and principles including various imaging devices. Measures of imaging quality through point spread function, resolution and spatial sampling.

Storage requirements, including image representation, coding and compression techniques, lossy versus lossless. Techniques for reducing noise in images, feature enhancement and recognition. Image enhancement including contrast manipulation, histogram equalization and derivative based operators. Segmentation and thresholding techniques Applications of morphology to image processing including erosion and dilation operations for binary and grey scale images. Filtering and transform techniques for image processing including two dimensional Fourier transforms, wavelets and convolution. Extension topics may include image registration, super-resolution techniques for video processing and object classification using features extracted from images.

ELEC ENG 4062

Distributed Generation Technologies

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1009 or ELEC ENG 1010, ELEC ENG 2008

Assessment: Quizzes and a major assignment

Introduction to distributed generation. Overview of distributed energy resources, including combustion engine generator sets, combustion turbines, photovoltaic systems, microturbines, fuel cells and energy storage technologies. Principles of control of distributed generation systems. Electric power distribution systems, installation, interconnection and integration. Economic and financial aspects of distributed generation, the regulatory environment and standards.

ELEC ENG 4063

Communications IV

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 3033

Incompatible: ELEC ENG 4035

Assessment: Examination and assignments

Frequency domain analysis, analogue signal transmission and reception, random processes, effect of noise on analog communication systems. Information sources and source coding, digital transmission in additive white Gaussian noise channel and band-limited AWGN. Channel capacity and coding, fading multipath channels and spread spectrum communications.

ELEC ENG 4064

Business Management Systems

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: completion of at least two years of an engineering degree

Incompatible: ELEC ENG 4038 and STATS 4001

Assessment: Project work and examination

Business governance and social accountability. Business processes and business process management. Structure and content of a business management system (BMS), covering all business functions, including OH&S. Configuration control of the BMS. Relationship to quality assurance; ISO 9001 accreditation. Quality management and reliability. Enablement of the BMS using IT. Importance of training in use of the BMS.

More on financial governance. Basic financial accounting and reporting, including time value of money. Accounting for project planning and control. Relationship to project management.

More on engineering governance and engineering management. Engineering planning and control; engineering functional management; lifecycle management, product safety; authorization of outputs.

ELEC ENG 4065

Avionic Sensors and Systems

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 2007, Fourier transforms, Matlab, some familiarity with electromagnetic ideas

Assessment: Final exam: 70%, Assignments & Quizzes: 30%

Radar sensors and systems

Airborne and ground antennas and propagation

Celestial navigation and communications

Air data sensors and systems

Inertial sensors and systems: gyros and accelerometers, attitude derivation, INS

Electro-optical sensors and systems

Display: head up display, helmet mounted displays, optical design, human factor, display management

Multi-sensor data fusion

Avionics systems integration, avionics environment DO-160, electromagnetic compatibility, fault tolerance

UAV avionics

ELEC ENG 4066

Advanced Signal Processing & Control

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: ELEC ENG 3027 and ELEC ENG 3033

Assessment: Tests, assignments, exam

State space modeling of deterministic and stochastic linear systems, state estimation, Kalman filtering, LQ and LQG optimal control, robustness, non-linear estimation and control

Mathematics

MATHS 1008

Mathematics for Information Technology I

3 units - semester 2

Up to 5 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Mathematical Studies

Assessment: ongoing assessment 30%, exam 70%

This course provides an introduction to a number of areas of discrete mathematics with wide applicability. Areas of application include: computer logic, analysis of algorithms, telecommunications, gambling and public key cryptography. In addition it introduces a number of fundamental concepts which are useful in Statistics, Computer Science and further studies in Mathematics.

Topics covered are: Discrete mathematics: sets, relations, logic, graphs, mathematical induction and difference equations; probability and permutations and combinations; information security and encryption: prime numbers, congruences.

MATHS 1009

Introduction to Financial Mathematics I

3 units - semester 1

Up to 5 hours per week

Restriction: Not available to BMathSci, BMa&CompSc & BCompSci students

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Methematical Studies

Incompatible: ECON 1005, MATHS 1011 & MATHS 1012 or MATHS 1013

Assessment: ongoing assessment 30%, Final exam 70%

Together with Applications of Quantitative Methods in Finance I, this course provides an introduction to the basic mathematical concepts and techniques used in finance and business and includes topics from calculus, linear algebra and probability, emphasising their inter-relationships and applications to the financial area; introduces students to the use of computers in mathematics; develops problem solving skills with a particular emphasis on financial and business applications.

Topics covered are: polynomial, exponential, logarithmic functions, interest rates and annuities, Linear Equations, matrices and determinants. Linear programming

MATHS 1010

Applications of Quantitative Methods in Finance I

3 units - semester 2

Up to 5.5 hours per week

Restriction: Not available to BMathSci, BMa&CompSc & BCompSci students

Available for Non-Award Study

Pre-Requisite(s): MATHS 1009

Incompatible: MATHS 1011 & MATHS 1012, MATHS 1013

Assessment: ongoing assessment 30%, exam 70%

Together with MATHS 1009 Introduction to Financial Mathematics I, this course provides an introduction to the basic mathematical concepts and techniques used in finance and business and includes topics from calculus, linear algebra and probability, emphasising their inter-relationships and applications to the financial area; introduces students to the use of computers in mathematics; develops problem solving skills with a particular emphasis on financial and business applications.

Topics covered are: Calculus: differential and integral calculus with applications; functions of two real variables. Probability: basic concepts, conditional probability; probability distributions and expected value with applications to business and finance.

MATHS 1011

Mathematics IA

3 units - semester 1 or semester 2

Up to 5.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): SACE Stage 2 Math.Studies & SACE Stage 2 Specialist Maths or MATHS 1013

Assessment: ongoing assessment 30%, exam 70%

This course, together with MATHS 1012 Mathematics 1B, provides an introduction to the basic concepts and techniques of calculus and linear algebra, emphasising their inter-relationships and applications to engineering, the sciences and financial areas; introduces students to the use of computers in mathematics; and develops problem solving skills with both theoretical and practical problems.

Topics covered are: Calculus: functions of one variable, differentiation, the definite integral, and techniques of integration. Algebra: Linear equations, matrices, the real vector space determinants, optimisation, eigenvalues and eigenvectors; applications of linear algebra.

MATHS 1012

Mathematics IB

3 units - summer semester or semester 1 or semester 2

Up to 5.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1011

Incompatible: MATHS 2004 & MATHS 2105

Assessment: ongoing assessment 30%, exam 70%

This course, together with MATHS 1011 Mathematics IA, provides an introduction to the basic concepts and techniques of calculus and linear algebra, emphasising their inter-relationships and applications to engineering, the sciences and financial areas; introduces students to the use of computers in mathematics; and develops problem solving skills with both theoretical and practical problems.

Topics covered are: Calculus: Applications of the derivative; functions of two variables; Taylor series; differential equations.

Algebra: The real vector space, eigenvalues and eigenvectors, linear transformations and applications of linear algebra.

MATHS 1013

Mathematics IMA

3 units - semester 1

Up to 5.5 hours per week

Restriction: This course is not available to students with combined (subject achievement) score of 35 or greater for SACE Stage 2 Math Studies & SACE Specialist Maths or equivalent

Available for Non-Award Study

Pre-Requisite(s): SACE Stage 2 Mathematical Studies

Assessment: ongoing assessment 30% exam 70%

This course provides the necessary additional mathematics to prepare students for MATHS 1011 Mathematics IA. The course contains an introduction to basic concepts and techniques of calculus and linear algebra, emphasising their inter-relationships and applications to the sciences and financial areas; introduces students to the use of computers in mathematics; and develops problem solving skills with a particular emphasis on applications.

Topics covered are: Calculus: differential calculus with applications; an introduction to differential equations; Algebra: complex numbers; vectors, linear equations and matrices; applications of linear algebra.

MATHS 2100

Real Analysis

3 units - semester 2

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Incompatible: PURE MTH 2003, PURE MTH 3017 or 7389 (pre-2002)

Assessment: ongoing assessment 30%, exam 70%

Much of mathematics relies on our ability to be able to solve equations, if not in explicit exact forms, then at least in being able to establish the existence of solutions. To do this requires a knowledge of so-called ``analysis", which in many respects is just Calculus in very general settings. The foundations for this work are commenced in Real Analysis, a course that develops this basic material in a systematic and rigorous manner in the context of real-valued functions of a real variable.

Topics covered are: Basic set theory. The real numbers, least upper bounds, completeness and its consequences. Sequences: convergence, subsequences, Cauchy sequences. Open, closed, and compact sets of real numbers. Continuous functions, uniform continuity. Differentiation, the Mean Value Theorem. Sequences and series of functions, pointwise and uniform convergence. Power series and Taylor series. Metric spaces: basic notions generalised from the setting of the real numbers. The space of continuous functions on a compact interval. The Contraction Principle. Picard's Theorem on the existence and uniqueness of solutions of ordinary differential equations.

MATHS 2101

Multivariable & Complex Calculus

3 units - semester 1

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Incompatible: PURE MTH 2005, PURE MTH 3016, MATHS 2202 or 7389 (pre-2002)

Assessment: ongoing assessment 30%, exams 70%

The mathematics required to describe most "real life" systems involves functions of more than one variable, so the differential and integral calculus developed in a first course in Calculus must be extended to functions of more variables. In this course, the key results of one-variable calculus are extended to higher dimensions: differentiation, integration, and the link between them provided by the Fundamental Theorem of Calculus are all generalised. The machinery developed can be applied to another generalisation of one-variable Calculus, namely to complex calculus, and the course also provides an introduction to this subject. The material covered in this course forms the basis for mathematical analysis and application across an extremely broad range of areas, essential for anyone studying the hard sciences, engineering, or mathematical economics/finance.

Topics covered are: introduction to multivariable calculus; differentiation of scalar- and vector-valued functions; higher-order derivatives, extrema, Lagrange multipliers and the implicit function theorem; integration over regions, volumes, paths and surfaces; Green's, Stokes' and Gauss's theorems; differential forms; curvilinear coordinates; an introduction to complex numbers and functions; complex differentiation; complex integration and Cauchy's theorems; and conformal mappings

MATHS 2102

Differential Equations

3 units - semester 1

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Incompatible: APP MTH 2007, APP MTH 2000, APP MTH 2010, APP MTH 2010, MATHS 2201

Assessment: ongoing assessments 30%, exams 70%

Most "real life" systems that are described mathematically, be they physical, financial, economic or some other kind, are described by means of differential equations. Our ability to predict the way in which these systems evolve or behave is determined by our ability to find solutions of these equations explicitly or to be able to approximate solutions as accurately as we need. Every differential equation presents its own challenges, but there are various classes of differential equations, and for some of these there are established approaches and methods for solving them. This course presents some of the most important such methods.

Topics covered are: first order ordinary differential equations (ODEs), higher order ODEs, numerical techniques for solving ODEs, systems of ODEs, series solutions of ODEs, Laplace transforms, Fourier analysis, solution of linear partial differential equations using the method of separation of variables, and D'Alembert's solution of the wave equation.

MATHS 2103

Probability & Statistics

3 units - semester 1

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Incompatible: STATS 2002, STATS 2003 & STATS 2011

Assessment: ongoing assessment 30%, exam 70%

Probability theory is the branch of mathematics that deals with modelling uncertainty. It is important because of its direct application in areas such as genetics, finance and telecommunications. It also

forms the fundamental basis for many other areas in the mathematical sciences including statistics, modern optimisation methods and risk modelling. This course provides an introduction to probability theory, random variables and Markov processes.

Topics covered are: probability axioms, conditional probability; Bayes' theorem; discrete random variables, moments, bounding probabilities, probability generating functions, standard discrete distributions; continuous random variables, uniform, normal, Cauchy, exponential, gamma and chi-square distributions, transformations, the Poisson process; bivariate distributions, marginal and conditional distributions, independence, covariance and correlation, linear combinations of two random variables, bivariate normal distribution; sequences of independent random variables, the weak law of large numbers, the central limit theorem; definition and properties of a Markov chain and probability transition matrices; methods for solving equilibrium equations, absorbing Markov chains.

MATHS 2104

Numerical Methods

3 units - semester 2

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: MATHS 2102

Incompatible: APP MTH 2004 or APP MTH 2009

Assessment: ongoing assessment 30%. exam 70%

To explore complex systems, physicists, engineers, financiers and mathematicians require computational methods since mathematical models are only rarely solvable algebraically. Numerical methods, based upon sound computational mathematics, are the basic algorithms underpinning computer predictions in modern systems science. Such methods include techniques for simple optimisation, interpolation from the known to the unknown, linear algebra underlying systems of equations, ordinary differential equations to simulate systems, and stochastic simulation under unknown influences.

Topics covered are: the mathematical and computational foundations of the numerical approximation and solution of scientific problems; simple optimisation; vectorisation; clustering; polynomial and spline interpolation; pattern recognition; integration and differentiation; solution of large scale systems of linear and nonlinear equations; modelling and solution with sparse equations; explicit schemes to solve ordinary differential equations; random numbers; stochastic system simulation

MATHS 2201

Engineering Mathematics 1

3 units - semester 1

Up to 3.5 hours per week

Restriction: Available to BE students only

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Incompatible: APP MTH 2000, APP MTH 2007, APP MTH 2010, MATHS 2102, STATS 2004, STATS 1000

Assessment: ongoing assessment 30%, exam 70%

Mathematical models are used to understand, predict and optimise engineering systems. Many of these systems are deterministic and are modelled using differential equations. Others are random in nature and are analysed using probability theory and statistics. This course provides an introduction to differential equations and their solutions and to probability and statistics, and relates the theory to physical systems and simple real world applications.

Topics covered are: Ordinary differential equations, including first and second order equations and series solutions; Fourier series; partial differential equations, including the heat equation, the wave equation, Laplace's equation and separation of variables; probability and statistical methods, including sampling and probability, descriptive statistics, random variables and probability distributions, mean and variance, linear combinations of random variables, statistical inference for means and proportions and linear regression.

MATHS 2202

Engineering Mathematics II

3 units - semester 2

Up to 3.5 hours per week

Restriction: Available to BE students only

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: MATHS 2201 or APP MTH 2000

Incompatible: APP MTH 2002, APP MTH 2006 or MATHS 2101

Assessment: Final exam, assignments and/or practicals

This course provides an introduction to vector analysis and complex calculus, which is relevant to physics and engineering problems in two or more dimensions, such as solid and fluid mechanics, electromagnetism and thermodynamics. The course also introduces Laplace transform methods for solving differential equations, which have application to engineering problems such as circuit analysis and control.

Topics covered are: Vector calculus: vector fields; gradient, divergence and curl; line, surface and volume integrals; integral theorems of Green, Gauss and Stokes with applications; orthogonal curvilinear coordinates. Complex analysis: elementary functions of a complex variable; complex differentiation; complex contour integrals; Laurent series; residue theorem. Laplace transforms: transforms of derivatives and integrals; shifting theorems; convolution; applications to differential equations.

MATHS 3015

Communication Skills III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012, MATHS 2004 or COMP SCI 1009

Incompatible: CHEM ENG 3004, C&ENVENG 3000, ELEC ENG 3012, MECH ENG 3006 & 9007 (pre-2002)

Assessment: ongoing assessment 30%, exam 70%

In the modern world skill at communicating mathematics is sometimes just as important as skill at doing mathematics. This course develops students' skills in both the written and verbal communication of mathematics. In addition the general communication skills which are fundamental to getting and keeping a job are taught. The course encourages student learning with a range of interesting teaching techniques including guest lecturers and workshops.

Topics covered are: the writing process, abstracts and summaries, communicating with non-technical audiences, writing professional documents, preparation and delivery of presentations, ethics and professional practice, preparation of job applications, and interviews.

MATHS 4000A/B

Honours Mathematical Sciences Part 1 & 2

24 units - full year

Restriction: Available only to students admitted to the relevant Honours program

Pre-Requisite(s): At least 12 units of Level III Mathematical Sciences courses, at credit standard - different backgrounds may be accepted at discretion of the Head of School

Assessment: exams for each course at end of semester in which it is offered, project, seminar

Students are required to obtain the approval of the Head of Mathematical Sciences before enrolling in the program, and should preferably consult with the Head before enrolling for Level III. Candidates may apply to the Head for permission, under certain circumstances, to take Honours over two years.

Students select from lecture courses offered by the School of Mathematical Sciences and other Schools as may be agreed to by Head of Mathematical Sciences. Students may be allowed to take appropriate Level III Mathematical Sciences courses not already taken.

Students are assigned a supervisor to advise on and approve their lecture program and give guidance in writing a project on a Mathematics topic. Possible topics should be discussed with staff during the preceding year.

Mechanical Engineering

MECH ENG 1006

Design Graphics and Communication

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assessment: continuous assessment, final exam - further details at beginning of semester

The course introduces students to internationally accepted standards of both written and graphical engineering communication methods. Students will learn the fundaments of professional engineering oral, written and team communication as well as manual and computer aided drawing skills.

MECH ENG 1007

Engineering Mechanics - Dynamics

3 units - summer semester or semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Math.Studies, Specialist Maths, Physics

Assessment: mid-semester test, assignments, exam

This course teaches students how to apply Newtonian physics to relatively simple physical situations. It follows on from the Statics course, but considers systems that are not in equilibrium i.e. with velocity and acceleration. Some of the topics covered are pure kinematics (a mathematical description of motion only), while others are kinetic (determine motion in problems involving the concepts of force and energy). The course restricts itself to 2-D (planar) mechanisms.

MECH ENG 1100

Introduction to Mechanical Engineering

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies

Assessment: Assignments, Final exam

This introductory course is made up of three modules that teach fundamental skills that Engineering students require. Introduction to your Discipline presents an overview of the activities undertaken as a professional in your discipline, providing context for your Engineering studies. Programming in C & MATLAB teaches students the importance of computer programming in Engineering. Students will learn how to analyse computing problems, develop algorithms to describe solutions to these problems, and software implementations in the C and MATLAB programming environments. Puzzle Based Learning teaches students how to solve problems, including techniques for understanding problems, modelling problems and approaches to problem solving.

MECH ENG 1101

Introduction to Automotive Engineering

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies

Assessment: Assignments, Final exam

This introductory course is made up of three modules that teach fundamental skills that Engineering students require. Introduction to your Discipline presents an overview of the activities undertaken as a professional in your discipline, providing context for your Engineering studies. Programming in C & MATLAB teaches students the importance of computer programming in Engineering. Students will learn how to analyse computing problems, develop algorithms to describe solutions to these problems, and software implementations in the C and MATLAB programming environments. Puzzle Based Learning teaches students how to solve problems, including techniques for understanding problems, modelling problems and approaches to problem solving.

MECH ENG 1102

Introduction to Aerospace Engineering

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies

Assessment: Assignments, Final exam

This introductory course is made up of three modules that teach fundamental skills that Engineering students require. Introduction to your Discipline presents an overview of the activities undertaken as a professional in your discipline, providing context for your Engineering studies. Programming in C & MATLAB teaches students the importance of computer programming in Engineering. Students will learn how to analyse computing problems, develop algorithms to describe solutions to these problems, and software implementations in the C and MATLAB programming environments. Puzzle Based Learning teaches students how to solve problems, including techniques for understanding problems, modelling problems and approaches to problem solving.

MECH ENG 1103

Introduction to Mechatronic Engineering

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies

Assessment: Assignments, Final exam

This introductory course is made up of three modules that teach fundamental skills that Engineering students require. Introduction to your Discipline presents an overview of the activities undertaken as a professional in your discipline, providing context for your Engineering studies. Programming in C & MATLAB teaches students the importance of computer programming in Engineering. Students will learn how to analyse computing problems, develop algorithms to describe solutions to these problems, and software implementations in the C and MATLAB programming environments. Puzzle Based Learning teaches students how to solve problems, including techniques for understanding problems, modelling problems and approaches to problem solving.

MECH ENG 1104

Introduction to Sports Engineering

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies

Assessment: Assignments, Final exam

This introductory course is made up of three modules that teach fundamental skills that Engineering students require. Introduction to your Discipline presents an overview of the activities undertaken as a professional in your discipline, providing context for your Engineering studies. Programming in C & MATLAB teaches students the importance of computer programming in Engineering. Students will learn how to analyse computing problems, develop algorithms to describe solutions to these problems, and software implementations in the C and MATLAB programming environments. Puzzle Based Learning teaches students how to solve problems, including techniques for understanding problems, modelling problems and approaches to problem solving.

MECH ENG 1105

Introduction to Sustainable Energy Engineering

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies

Assessment: Assignments, Final exam

This introductory course is made up of three modules that teach fundamental skills that Engineering students require. Introduction to your Discipline presents an overview of the activities undertaken as a professional in your discipline, providing context for your Engineering studies. Programming in C & MATLAB teaches students the importance of computer programming in Engineering. Students will learn how to analyse computing problems, develop algorithms to describe solutions to these problems, and software implementations in the C and MATLAB programming environments. Puzzle Based Learning teaches students how to solve problems, including techniques for understanding problems, modelling problems and approaches to problem solving.

MECH ENG 2002

Stress Analysis and Design

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Aerospace), BE(Automotive), BE(Computational), BE(Mechanical), BE(Mechatronic), BE (Sports) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: MECH ENG 1007 & C&ENVENG 1010

Assessment: assignments, quizzes, finite element labs, laboratory experiments, exam

Concept of stress and strain, characterisation of stress-strain curves and failure of metals, plastics and wood, Hooke's law in tension/compression and shear, axially loaded members, Saint-Venant's principle, non-linear deformation, statically indeterminate structures, thermal stresses, torsion of circular bars and tubes, bending, stresses in beams, combined loading, deflection of beams, buckling instability, analysis of stress and strain, Mohr's circle, generalized Hooke's law, strain energy, energy methods, elementary theories of plasticity and failure, intro to design of columns, shafts, pressure vessels, welded joints, fasteners and springs and Finite Element Analysis.

MECH ENG 2015

Electronics IIM

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Mechatronic) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1009

Assessment: practical work, assignments, final exam

Amplifier models and imperfections. Operational amplifiers and their applications. Diodes, rectifier circuits, wave-shaping circuits, diode logic circuits and voltage regulator circuits. Characteristics of Transistors (BJTs and FETs), modelling transistors and circuits. Circuits analysis. Active filters, PSPICE, and some practical circuits using the learned components.

MECH ENG 2019

Dynamics and Control I

3 units - semester 2

Up to 4.5 hours per week

Restriction: Available to BE(Aerospace), BE(Automotive), BE(Computational), BE(Mechanical), BE(Mechatronic), BE (Sports) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: MECH ENG 1007, APP MTH 220 &, ELEC ENG 1009

Assessment: small tests, assignments, laboratory experiments, final exam

Students will be introduced to various applications of feedback control systems and develop fundamentals associated with modelling, analysis, design and simulation of automatic control systems. This course also aims to introduce the basic concepts of machine dynamics and their engineering applications, and deals with the analysis, design and application of a variety of mechanisms.

MECH ENG 2020

Materials and Manufacturing

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Aerospace), BE(Automotive), BE(Computational), BE(Mechanical) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1009

Assessment: assignments, final exam

Extend the fundamental understanding of the structure - property relationship of materials introduced in previous courses; mechanical behaviour, testing and manufacturing properties of ferrous, non-ferrous, polymeric, ceramic and composite materials; strengthening of materials (alloying, heat-treatment); manufacturing processes, design considerations and economics for forming and shaping engineering materials (casting, forging, rolling, extrusion, injection moulding, machining)

MECH ENG 2021

Thermo-Fluids I

3 units - semester 1

Up to 4.5 hours per week

Restriction: Available to BE(Aerospace), BE(Automotive), BE (Computational), BE(Mechanical), BE(Mechatronic), BE(Petroleum), BE (Sports) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: MATHS 1011 & MATHS 1012, C&ENVENG 1010 & MECH ENG 1007

Assessment: assignments, practicals, final exam

An introduction to mechanical engineering thermodynamics dealing with the application of the first and second laws of thermodynamics to the thermodynamic design and performance analysis of typical thermo-mechanical plant using condensable vapours and gases as the working fluid. Basic fluid mechanics including: kinematics and dynamics of fluid flows; conservation laws applied to fluid flow; Euler, Bernoulli, Navier-Stokes equations; dimensional analysis; differential and integral flow analysis; flow visualisation.

MECH ENG 2100

Design Practice

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MATHS 1012, C&ENVENG 1001 or C&ENVENG1010 & MECH ENG 1000 or MECH ENG1007

Incompatible: MECH ENG 2018

Assessment: Assignments, reports, practicals, final exam

In general the course is an introduction to engineering design. It will cover basic stages of the design process and fundamentals of good design practices. It will also look at design of some specific mechanical sub-systems and will introduce students to some basic manufacturing processes. Students will also learn effective communication skills by means of individual and group engineering reports. The course is divided into two major components:

Design Project where students will work in teams on a design/build/test competition project while completing a number of group assignments. In this part students will learn effective team work practices and project management while going through basic stages of the design process such as conceptual, embodiment and detail design.

In Design for Function a number of power transmitting sub-systems, commonly used in mechanical design will be looked at. In individual assignments students will design such sub-systems using both first principles and according to standard processes. Students will learn such fundamental aspects of design as using sources of design information; accuracy of engineering quantities; material selection; fabrication methods, and tolerances and fits.

MECH ENG 2101

Mechatronics 1M

3 units - semester 2

36 hours lectures, practicals, 40 hours workshop practice (mid-year break)

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1008 or ELEC ENG 1009 & MECH ENG 1007 & MECH ENG 2021

Incompatible: MECH ENG 2004 or MECH ENG 2011

Assessment: Assignments, in-class quizzes, Final exam, laboratory experiments

To provide an introduction to the application of electronic control systems in mechanical and electrical engineering. To give framework of knowledge that allows students to develop an interdisciplinary understanding and integrated approach to mechatronic engineering. In the Workshop Practice component, organized during the semester break, students will become familiar with basic workshop practices, including machining and the use of hand tools.

MECH ENG 2102

Sports Engineering 1

3 units - semester 1

Up to 3 hours per week, plus 40 hour workshop practice in mid-year break

Available for Non-Award Study

Assumed Knowledge: ELEC ENG 1009, MATHS 1012

Assessment: Assignments, Final exam

Includes Workshop Practice

Instrumentation of sports equipment, athletes and sports facilities is an invaluable tool for quantifying sports performance and optimising training. The development of smart equipment is an emerging area, which enables advanced training including biofeedback methods. Recent developments in sensor and wireless technologies like cost reduction, miniaturisation, and improvement in reliability and accuracy open new avenues for instrumentation in sport.

This course introduces the fundamental concepts of instrumentation including principles of sensors and data processing, and specifically the instrumentation of sports equipment, athletes and sports facilities. The course addresses the design of instrumented equipment in conjunction with equipment rules and size constraints, the effective instrumentation of athletes in conjunction with worn markers and sensors, and the potential of non-contact instrumentation embedded in sports facilities. One topic covers the design of cost-effective do-it-yourself instrumentation.

MECH ENG 3026

Aerospace Materials and Structures

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Aerospace) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2002, Level 2 Applied Maths courses with an aggregate value of 6 units

Assessment: assignments, quizzes, finite element labs, laboratory experiment, exam

Concepts of stress and strain tensors, elasticity, plasticity, viscoelasticity and creep, elementary solutions of theory of elasticity and plasticity; Intro to the Principle of Minimum Potential energy and Fracture Mechanics; Advanced Finite Element (FE) modelling; Experimental techniques; types of materials used in the aerospace industry, including metals, ceramics and composites. Selection of the appropriate material for a variety of applications will be discussed in terms of the material properties, ease of manufacture and performance in the anticipated service environment. Case studies will be used to demonstrate the design principles used when using each of these materials for aerospace applications.

MECH ENG 3027

Engineering Systems Design and Communication

3 units - semester 2

Up to 5 hours per week

Restriction: Available to BE(Aerospace), BE(Automotive), BE(Computational), BE(Mechanical), BE(Mechatronic), BE (Sports) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: MECH ENG 1006, MECH ENG 2100

Assessment: assignments 30%, final exam 70%

This course will cover all of the elements of the design process that are relevant to engineering projects. The various stages of the design process will be discussed including problem identification, concept generation, concept selection and design embodiment. Fundamentals of good design practices will also be covered including aesthetics, ergonomics and safety. The course also includes effective team work practices and project management. An essential aspect of engineering design is effective communication. Therefore the course provides written and spoken language development in the context of academic and professional engineering. Class work is designed to develop the capacity of students for effective communication relevant to their current studies and intended professional careers. Areas covered include logical cohesion, writing a research paper, integrating evidence and the effective presentation of individual and group seminars. Particular attention is given to explicit engineering report writing skills.

MECH ENG 3028

Dynamics and Control II

3 units - semester 2

Up to 4.5 hours per week

Restriction: Available to BE(Aerospace), BE(Computational), BE(Mechanical), BE(Mechatronic), BE (Sports) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: 6 units of Level II Applied Maths courses, MECH ENG 1007, MECH ENG 2019

Assessment: assignments, laboratory experiments, final exam

Dynamic systems are found everywhere, from musical instruments to transportation vehicles such as automobiles and aircraft. Even static civil structures such as bridges and buildings exhibit a dynamic response, which must be considered during design and construction of such systems.

This course introduces the fundamental concepts of vibrating dynamical systems, from single degree of freedom systems through to continuous and multi-degree of freedom systems. Design of vibration control devices, such as vibration isolators and vibration absorbers, is also considered.

Concurrently with the introduction to vibratory systems described above, this course also addresses how to control such dynamic systems using modern state-space control. This involves time domain descriptions of dynamic systems using state-space system models. The characteristics responsible for the dynamic response (poles, zeros, eigenvalues) are presented. Control laws using state-space are introduced, including specification of controller characteristics, controller design using pole placement and optimal (LQR) control (introduction). State observers are presented, including observer design using both pole placement and optimal (Kalman) observers (introduction). Finally, a computer aided control system design methodology is applied to a real MIMO Aerospace platform and several other unstable MIMO systems.

MECH ENG 3030

Structural Design and Solid Mechanics

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Mechanical), BE(Computational) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: 6 units of Level II Applied Maths courses & MECH ENG 2002

Assessment: assignments, final exam

Concepts of stress and strain tensor, elasticity, plasticity, viscoelasticity and creep, elementary solutions of theory of elasticity and plasticity, Airy's Stress Function, Principle of Minimum Potential Energy, Finite Element Analysis, waves in solids, intro to Fracture Mechanics, properties and behaviour of structural materials and elements together with fabrication, construction and durability aspects, preliminary sizing of members, assessment of loads, analysis and design of structural members for load capacity and serviceability.

MECH ENG 3032

Micro-Controller Programming

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Mechatronic) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1002 & MECH ENG 2011

Assessment: assignments, final exam

The focus of this course is on the programming and use of micro-controllers in mechatronics applications. Assuming basic knowledge of the C programming language, the material is presented in a combination of lectures, tutorials and hands-on laboratory sessions. The build process of micro-controller software is examined in great detail thereby providing the language for understanding compiler handbooks, on-line publications and micro-controller datasheets. The newly developed skills are then applied in a number of practical case studies covering typical mechatronics applications including servo-mechanisms, sensor interfacing, real-time issues and inter-platform communication. Emphasis will be laid on the confident use of the C programming language using a variety of programming environments. Fault finding techniques will be introduced, ranging from low-level in-circuit debugging to source-level debugging on simulators and evaluation boards. Small-group projects and case studies will be used to provide important hands-on experience with micro-controller based projects.

MECH ENG 3033

Automotive Materials and Structures

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Automotive) & associated double degree students only

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1003, APP MTH 2000, APP MTH 2002 & MECH ENG 2002

Assessment: assignment, quizzes, finite element labs, laboratory experiment, exam

The course examines the different types of materials used in the automotive industry, including metals, ceramics and composites. Selection of the appropriate material for a variety of applications will be discussed in terms of the material properties, ease of manufacture and performance in the anticipated service environment. Case studies will be used to demonstrate the design principles used when using each of these materials for automotive applications. The course develops an understanding of the mechanics of complex practical situations through the establishment and solution of an appropriate boundary value problem

MECH ENG 3100

Aeronautical Engineering

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2021, MECH ENG 2002

Incompatible: MECH ENG 3016 or MECH ENG 4008

Assessment: Assignments, Final exam

Aircraft types, Historical Overview of Aeronautical Engineering, Atmosphere Properties,

Coordinate Systems, Aircraft Geometries, Forces and Moments, Introduction to Low Mach Number Aerodynamics, Requirements for Flight Segments, Stability and Control, Thrust, Aircraft Loads, Bending of Beams, Shear of Beams, Torsion of Beams, Open and Closed Section Beams, Structural Idealization, Wing Spars and Box Beams, Fuselages, Wings, Fuselage Frames and Wing Ribs, Helicopter Aerodynamics,Vertical and Short takeoff and Landing Aircraft.

\MECH ENG 3101

Applied Aerodynamics

3 units - semester 2

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: 6 units of Level II Applied Maths courses & MECH ENG 2021

Assessment: Lab classes 10%, assignments 20%, Final exam 70%

The aim of this course is to introduce students to the fundamentals and practical aspects of incompressible and compressible flows and the design and operation of flow systems, including pipe networks, automobiles and flight vehicles. The course content includes: flow of inviscid and viscous fluids; laminar and turbulent flow in pipes and boundary layers; losses in pipe systems; lift and drag forces on moving bodies, aerofoil theory; incompressible-flow machines; fundamentals of compressible flow; 1-D pipe flow; compressible flow nozzles; Rayleigh flow; Fanno flow; external compressible flow around bodies including transonic and supersonic vehicles; design considerations; experimental techniques

MECH ENG 3102

Heat Transfer & Thermodynamics

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: 6 units of Level II Applied Maths courses & MECH ENG 2021

Assessment: Lab class 10%, assignments 20%, Final exam 70%

Heat transfer modes: Conduction, Convection and Radiation. Heat Exchanger design and optimisation, boiling evaporation and condensation. Vapour power cycles; refrigeration cycles; non-reacting mixtures; psychrometry; combustion.

MECH ENG 3103

Manufacturing Engineering & Quality Systems

3 units - semester 1

Up to 4 hours per week, plus site visits

Available for Non-Award Study

Incompatible: MECH ENG 2007 or MECH ENG 3015

Assessment: Assignments, Final exam

Plastics manufacturing, the design and control of advanced manufacturing systems. Techniques for the analysis and operation of manufacturing systems. Design for assembly, design for manufacture techniques. Quality management; design for quality statistical process control; quality techniques including quality function deployment and failure mode and effect analysis. Up to 6 invited industry lectures on four different topics will be used to convey applied quality management and control tropics. These lectures will complement introductory lectures held in the weeks directly prior to the individual industry talks.

MECH ENG 3104

Space Vehicle Design

3 units - semester 2

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: 6 units level 2 APP MTHS courses

Incompatible: MECH ENG 3025 or MECH ENG 4015

Assessment: Assignments, Final exam

The aim of the course is to introduce the students to the basic theories and design criteria of space vehicles. The first part of the course describes historical developments in space flight and the basic rocket equations, as well as the principles of rocket staging and its optimisation. This is followed by orbital theory, where two-body motion, manoeuvres and special trajectories are described. A section about rocket propulsion focuses on performance, propulsion requirements and various propellant systems (monopropellant, bipropellant, solid, cold gas and non-chemical propellant systems). Concluding the course will be a description of current developments in space flight, such as the International Space Station and missions to Mars.

MECH ENG 3105

Sustainability & the Environment

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: 6 units of Level 2 Maths courses

Incompatible: MECH ENG 3017

Assessment: Assignments, Final exam

Engineering ethics, noise assessment and control, air pollution assessment and control, water pollution assessment and control,

sustainability, sustainable design and manufacture, sustainable buildings, sustainable energy, Environmental impact statements, legislative requirements, climate change.

MECH ENG 3106

Mechatronics II

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Incompatible: MECH ENG 3014

Assessment: Assignments, Final exam

Advanced PLC programming and implementation, memory and data types, program structure, mathematic functions, floating point operation, and PLC industrial applications.

MECH ENG 3107

Sports Engineering II

3 units - semester 2

Up to 4.5 hours per week

Assumed Knowledge: MECH ENG 2102 & MECH ENG 2002

Assessment: assignments, final exam, compulsory laboratory experiments

Sports equipment is an integral part of sportive activity. Sophisticated and innovative design enhances the performance of athletes and prevents injuries. Equipment customised for elite athletes may provide a competitive edge. Sports and exercise equipment sales account for approximately 35 % of the global sporting goods market, whilst sports apparel comprises 50 % and athletic footwear 15 %.

This course introduces the fundamental concepts of sports equipment design and technology for competitive purposes, including customisation and legal principles of design within the rules. The course addresses the entire range of contemporary competitive equipment in conjunction with sport biomechanics, athletic performance and injury prevention. One topic covers the principle of expert witness reports for legal cases.

MECH ENG 3108

Sports Materials

3 units - semester 1

Up to 4.5 hours per week

Assumed Knowledge: CHEM ENG 1009, MECH ENG 2103 & MECH ENG 2002

Assessment: assignments, final exam, compulsory laboratory experiments

A solid foundation of materials science and engineering is required to successfully design sports equipment and to understand its structural properties. Sports equipment covers the full range of traditional biological materials like wood to advanced spacecraft materials. The appropriate selection and design of sports materials enhances the performance of athletes and prevents injuries.

This course introduces the fundamental concepts of material models including mathematical modelling, followed by specific properties and applications of materials for the design of sports equipment. One topic provides the design guide for protective equipment. The section on materials testing covers the fundamental concepts of experimental design and specific application to sports equipment according to rules and standards issued by governing sporting bodies and professional associations. The section on human biological materials covers the biomechanics of soft and hard tissues and their importance for sports injuries

MECH ENG 3109

Engineering Biomechanics

3 units - not offered in 2011

Up to 4.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): C&ENVENG 1010, MECH ENG 1007, MECH ENG 2019 & MECH ENG 2103

Assessment: assignments, final exam, compulsory laboratory experiments

A solid foundation of Biomechanics is required to perform advanced sports biomechanics analyses and to understand the effects of sports equipment on the human body. The course is designed as an Engineering Biomechanics course, involving design elements, systems engineering approach, analysis of biological mechanisms, and engineering problem identification and decision making. The practical contents of this course outweigh the theoretical part, which relies on prerequisites and assumed knowledge from Level 1 and 2 courses.

The course introduces the fundamental concepts of Engineering Biomechanics and applies them to force analysis for clinical and sports purposes as well as to kinematic analysis. The course addresses the mathematical determination of muscle and joint forces and decision making based on mathematical results (e.g., which muscle is active, which ligament is loaded, will a joint dislocate or not). The major part of the course focuses on practical calculation of muscle and joint forces as well as critical interpretation of the results.

MECH ENG 4100

Advanced Topics in Aerospace Engineering

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Incompatible: MECH ENG 4063

Assessment: Assignments, Final exam

The course focuses on design and analysing the new and advanced types of flying vehicles. It firstly introduces the methods of calculating the stability, aerodynamic derivatives and handling quality parameters of an aircraft. It is followed by flight test analysing as well as unmanned aerial vehicle design methods. The course is concluded by introducing the satellite, hypersonic vehicle and helicopter design method.

MECH ENG 4101

Biomechanical Engineering

3 units - not offered in 2011

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2002

Incompatible: MECH ENG 4057

Assessment: Assignments, laboratory experiments, Final exam

This course will provide an introduction to the fundamentals of the structure and mechanics of the musculoskeletal system with application of mechanics to bone, tendon, cartilage, ligaments and other biological materials. The structure and function of the major

joints in the body will be covered, such as the hip, knee and spine as well as multiple joint systems such as the shoulder, wrist and hand. Experimental and analytical methods used to understand the function of joints and artificial joints will be discussed throughout the course. At completion of this course, students will understand the concept of joint biomechanics and their function, and how artificial joints function, why they fail, as well as their limitations and emerging new technologies in the biomechanics field.

MECH ENG 4102

Advanced PID Control

3 units - semester 1

Up to 5.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2019 & MECH ENG 3028

Incompatible: MECH ENG 4011

Assessment: Tutorials, Assignments, Laboratories, Exams (written and Matlab)

Advanced topics in automatic control system design. Emphasis will be placed on techniques used to accommodate uncertainty in practical systems.

MECH ENG 4103

Advanced Computer Aided Engineering

3 units - semester 1

Up to 5.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 1001 or MECH ENG 1006

Incompatible: MECH ENG 3034

Assessment: Assignments, Final Exam

This course introduces the student to a variety of CAD, CAM and CAE packages that are currently available and in common use by the automotive industry. There will be hands on opportunities and the function and theories behind of each piece of software reviewed. Students will be encouraged to familiarise themselves with the operation of the software through problem based assignments.

MECH ENG 4104

Advanced Topics in Fluid Mechanics

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2021, MECH ENG 3031, Level II Applied Mathematics courses with an aggregate value of 6 units

Incompatible: MECH ENG 4023

Assessment: Assignments, Lab experiments, Final exam

This course builds on the concepts learned in core Mechanical Engineering courses and extends these to provide practical interpretive and predictive methods. The syllabus begins with a practical and theoretical overview of modern flow measurement techniques and the methods used to interpret velocity and flow data. These are then applied to the fundamental flow cases such as boundary layers and free shear flows. Specific applications of these flow cases are then given through the study of internal flow systems and external flows around air, ground and sea-going vehicles. These include wind tunnels, race cars, high-performance yachts, swimmers, sports balls, birds and fish.

MECH ENG 4105

Advanced Vibrations

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3028

Incompatible: MECH ENG 4020

Assessment: Assignments, Lab Experiments, Final Exam

Students will be introduced to advanced multi-degree of freedom system analysis techniques for vibroacoustic systems, including modal analysis, statistical energy analysis and finite element analysis.

MECH ENG 4106

Aerospace Propulsion

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: 6 units Level 2 Applied Maths

Incompatible: MECH ENG 4036 or MECH ENG 4037

Assessment: Assignments, Final exam

Introduction to air-breathing (gas turbines, ramjets, ducted rockets, scramjets) jet propulsion systems. Prediction of thrust, combustion reactions, specific fuel consumption and operating performance. Aerothermodynamics of inlets, combustors, nozzles, compressors, turbines. Jet engine combustion including thermochemistry, chemical kinetics and the combustion chamber. Jet engine noise and emissions. Overview of engine systems such as thrust reversal, internal air, starting and ignition, controls and instrumentation, power plant testing and installation, maintenance.

MECH ENG 4107

Airconditioning

3 units - semester 2

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3028, MECH ENG 3031,MECH ENG 3102

Incompatible: MECH ENG 4013

Assessment: Assignments, Lab experiments, Final exam

Vapour compression cycles; heat transfer in two-phase flow; types, selection and operation of refrigeration plant; psychrometrics; climatic data and its use; load estimation and analysis; constant and variable air volume systems; human comfort and health; cooling and dehumidifying coils; controls; fans and duct systems; system balancing; energy efficiency in buildings.

MECH ENG 4108

Aircraft Design

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3101, MECH ENG 3100

Incompatible: MECH ENG 4062

Assessment: Assignments, Final Exam

Aircraft design methodology, Technical task preparation, team working, Aircraft design organisation, Aircraft weight calculation, mission fuel weight, Sensitivity analysis, Standard requirements, First estimation of aircraft design parameters, Sizing, Drag polar estimation at low speed, Matching diagram, Aircraft three view and drawings, Overall configuration design, Fuselage design, Propulsion system selection and integration, Wing design considerations,

Empennage design considerations, Landing gear design and integration, Weight and balance analysis, Stability and control analysis.

MECH ENG 4109

Automotive Combustion, Power Train & NVH

3 units - semester 2

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3017 & MECH ENG 2021

Incompatible: MECH ENG 4043

Assessment: Assignments, Experiments, Final Exam

This course has two components and is taught by two lecturers. The first part introduces students to internal combustion engines, their efficiency and pollutants emission. It looks at the various emerging power technologies in the automotive industry and the current and alternative fuels and combustion processes. Choice of fuel and the design of efficient enginer operating parameters and their by products will also be discussed. The second part covers an introduction to vehicle refinement, characteristics of sound, exterior noise and control and interior noise and control.

MECH ENG 4110

Automotive Vehicle Dynamics & Safety

3 units - semester 2

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3028

Incompatible: MECH ENG 4044

Assessment: Assignments, Final exam

This course will educate students in automotive vehicle dynamics and safety. The course will cover the dynamics of vehicles on the road during normal operation as well as during impact and other crash scenarios. Specific topics include vehicle handling, stability and control, tyre dynamics, suspension design, braking performance, automotive safety, impact dynamics, road safety engineering and safety regulations.

MECH ENG 4111

CFD for Engineering Applications

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3102, MECH ENG 3101

Incompatible: MECH ENG 4046

Assessment: Assignments, Laboratory experiments, Final exam

The course will equip the students with the necessary knowledge to use advance computational techniques to solve problems related to flow mechanics. In particular, students will have hands on experience in using computational fluid dynamics to solve engineering problems. Numerical representation of flow behaviour and solution schemes and convergence criteria will be also covered in the course.

MECH ENG 4112

Combustion Technology & Emission Control

3 units - semester 1

Up to 4.5 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2021, MECH ENG 3102

Incompatible: MECH ENG 4002

Assessment: Assignments, Lab Experiments, Final exam

Combustion presently provides about 80% of global energy and is expected to be a major energy source for many years. At the same time combustion, particularly of fossil fuels, leads to serious pollution problems and is the primary source of human-derived greenhouse gas emissions. An important aspect of a transition to a more sustainable future is therefore to reduce the emissions from combustion-based plants, and to utilise alternative fuels, including bio-fuels. The aim of the course is to equip candidates with the knowledge and skills necessary to understand, analyse and design modern combustion systems for maximising output and minimising air pollution. Combustion involves both mixing of the fuel and oxidant and the subsequent chemical reactions. The course therefore involves consideration of both combustion aerodynamics and fuel properties. It covers fuel selection, alternative and waste fuels, the design principals involved in reducing pollutant emissions, modelling and safety.

MECH ENG 4113

Computational Acoustics

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3105

Incompatible: MECH ENG 4026

Assessment: Assignments, Lab experiments, Final exam

This course will provide an introduction to the use of computer modelling in environmental, architectural and the general noise level and acoustic performance prediction.

MECH ENG 4114

Corrosion: Principles and Prevention

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1009

Incompatible: MECH ENG 4061

Assessment: Assignments, Lab experiments, Final exam

This course presents the concepts behind corrosion and corrosion prevention. The different forms of corrosion are introduced, along with how to recognise them. Methods for assessing the extent of corrosion are described including the theory on the reaction chemistry. Finally, ways of designing against corrosion and slowing its progress are discussed. Topics covered include: Fundamentals of corrosion: free energy of oxidation, oxidation and reduction reactions, Pourbaix diagrams, corrosion kinetics, polarization curves, passivation. Design against corrosion. Investigating corrosion failures. Atmospheric and general corrosion, bimetallic corrosion. Differential aeration corrosion: pitting, corrosion, MIC. Environmentally assisted cracking, erosion. Case studies into corrosion failures, identifying mechanisms and evaluating mitigation strategies.

MECH ENG 4115

Engineering Acoustics

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3105 & 6 units of Level II Applied Maths courses

Incompatible: MECH ENG 4004

Assessment: Assignments, Lab experiments, Final exam

The fundamentals of sound wave description and propagation, the hearing mechanism, acoustic instrumentation, noise criteria, sound source types and radiated sound fields, outdoor sound propagation, sound power measurement techniques, sound in enclosed spaces, sound transmission loss, acoustic enclosures, mufflers.

MECH ENG 4116

Engineering Management & Professional Practice

3 units - not offered in 2011

Up to 4 hours per week

Available for Non-Award Study

Incompatible: MECH ENG 4038

Assessment: Assignments, Lab experiments, Final exam

Students will be taught and learn through self directed research the engineering issues of personnel and resource management, project and business management, risk management and the legal aspects pertaining to engineering businesses. The course will cover the principles of quality management and continual improvement, including: Justification for quality management and continual improvement, Overview of quality management system types, TQM, Lean Systems and The Six-Sigma Process, Advanced Product Quality Planning, Design Failure Mode Effect Analysis (DFMEA), Process Failure Mode Effect Analysis (PFMEA), Design Verification Plan and Report (DVP&R) and Case Studies.

MECH ENG 4117

Finance for Engineers

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Incompatible: MECH ENG 4039

Assessment: Assignments, Lab experiments, Final exam

This course aims to provide engineers with an introduction to the fundamentals of business decision-making common to all forms of organisation. The course focuses on the requirements of project management, including the need to communicate complex financial arguments effectively. It is designed to provide students with a basic understanding of financial statements, capital budgeting, cost behaviour and costing systems.

MECH ENG 4118

Finite Element Analysis of Structures

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2002, MECH ENG 2019 & MECH ENG 3028

Incompatible: MECH ENG 4059

Assessment: Assignments, Lab Experiments, Final exam

The course will equip the students with the necessary knowledge to use finite element analysis to solve problems related to solid mechanics, dynamics and heat-transfer. In particular, students will have hands-on experience in using finite element analysis software ANSYS and MSC Nastran to solve realistic engineering problems.

MECH ENG 4119

Fire Engineering

3 units - not offered in 2011

Up to 4 hours per week

Available for Non-Award Study

Incompatible: MECH ENG 4042

Assessment: Assignments, Lab experiment, Final exam

The lectures will cover the following topics: building fire safety fundamentals, basic concepts of fire and explosion, zone and field fire modelling, the history and philosophy of fire related building legislation, the Building Code of Australia, legal issues, fire load, fire development and design calculations, smoke management systems and design calculations, occupant egress and fire brigade access, fire suppression systems, fire brigade intervention, fire induced building collapse, human behaviour at time of fire and performance based fire engineering design solutions.

MECH ENG 4120

Fracture Mechanics

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: 6 units of Level II Applied Maths courses & MECH ENG 2002 &MECH ENG 3030

Incompatible: MECH ENG 4003

Assessment: Assignments, Lab Experiments, Final exam

The focus of this course is on the principles of linear elastic and elasto-plastic fracture mechanics and their application to engineering design. The material is presented in a conversational, yet rigorous, manner with the focus on basic concepts, models and techniques devised to solve specific engineering problems. The choice of the subject matter was determined largely by needs of aeronautical and mechanical engineering, although it is believed that the subject matter will be found just as useful for automotive, civil engineering and naval architecture.

MECH ENG 4121

Material Selection & Failure Analysis

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1009

Incompatible: MECH ENG 4024

Assessment: Assignments, Lab experiments, Final exam

To introduce students to various tools that can be used to select the appropriate material for a given application. Examination of various failure modes to allow students to identify these modes in real samples and apply material selection and failure analysis techniques to failure prevention.

MECH ENG 4123

Advanced Digital Control

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3028

Incompatible: MECH ENG 4053

Assessment: Assignments, Final exam

This course concerns the design, analysis and implementation of advanced mechatronics control systems. Discrete time systems

and the sampling process are examined. Digital state-space control methods are considered in detail alongside Artificial Intelligence (AI) techniques including Fuzzy Logic and Artificial Neural Networks. Emphasis is given to algorithm implementation, and implementation platforms studied include micro-controllers, digital signal processors and field-programmable gate arrays.

MECH ENG 4124

Robotics M

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MATHS 1012, MECH ENG 2019 & MECH ENG 3028

Incompatible: MECH ENG 4027

Assessment: Assignments, Final exam

Two main categories: robotic manipulator and advanced robotic topics. Robotic manipulator includes: classification of robotic systems; transformation of coordinates; kinematics and inverse kinematics; Jacobians and robot dynamics; trajectory generation; modelling; control. Topics of Advanced robotics includes wheeled mobile robot; machine vision basics; introduction to air, space and underwater robots; robot plume tracing, mobile robot trajectory generation; robotics in mining; other new robotic developments.

MECH ENG 4125

Stresses in Plates & Shells

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 2002, plus at least 6 units of Level II APP MTHS courses

Incompatible: MECH ENG 4055

Assessment: Assignments, Final exam

The course examines fundamentals of the theory of surfaces, Kirchhoff Hypotheses, fundamental equations of the classical plate theory, symmetrical bending of circular plates, bending of rectangular plates, anisotropic plates and plates of various shapes, Navier's solution and Levy's method for rectangular places, special and approximate methods in theory of plates and shells, thermal stresses in plates, theory of edge effect, buckling, membrane theory of shells, bending theory of axisymmetrically loaded circular cylindrical shells and its application to pipes, tanks and pressure vessels, finite element analysis of plate and shell structures.

MECH ENG 4126

Topics in Welded Structures

3 units - not offered in 2011

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: CHEM ENG 1009

Incompatible: MECH ENG 4025

Assessment: Assignments, Lab experiments, Final exam

This course presents the concepts behind welding and joining technology. These include welding and joining techniques, equipment and consumables, weldability of engineering materials, economics, standards, health and safety, testing and repair. The concepts are then applied to the design and fabrication of engineering components, process plant and structures. The importance of selecting the correct welding process and parameters for a particular application will be demonstrated by investigating several case studies. Since a weld/joint can have a profound effect on the performance of a component depending on the in-service conditions it experiences, the influence of service environment will be investigated. At the end of the course students should have the concepts to assist in the selection of processes and parameters to make appropriately designed, sound joints, fit for service in the operating environment.

MECH ENG 4127

Wind Engineering

3 units - not offered in 2011

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 3031

Assessment: Assignments, Lab Experiments, Final exam

This course provides an introduction of meteorology to describe the atmospheric boundary layer and the climate of wind. It then demonstrates the application of fundamental fluid mechanics principles to basic bluff body aerodynamics in subsequently determining environmental wind effects and dynamic response of a structure in turbulent wind flow. Use of wind tunnel experimental measurements as well as wind codes and Australian Standard AS/NZS 1170.2:2002 to evaluate design wind speeds and structural response are also included

MECH ENG 4140

Sports Engineering III

3 units - semester 2

Up to 4.5 hours per week

Assumed Knowledge: MECH ENG 2019, MECH ENG 2102, MECH ENG 2002, MECH ENG 3101, MECH ENG 3108, MECH ENG 3107

Assessment: assignments, final exam, compulsory laboratory experiments

Sports equipment and facilities are an integral part of sportive activity and society. Sophisticated and innovative design of sports equipment and exercise machines enhances the performance of athletes. The huge manufacturing and sales numbers have an impact on the environment.

This course introduces the fundamental concepts of

1) aero- and fluid dynamics for sports equipment design,

2) the design of sports facilities and stadia,

3) eco- and sustainable design of sports equipment.

Aero- and fluid dynamics includes sports equipment like balls, apparel, and equipment for aeronautical, water, and transportation sports. Sports facilities design includes exercise machines, management and maintenance, as well as safety, structural and energy issues of stadium design. Ecodesign of sports equipment addresses the ecological impact of equipment manufacturing and disposal on the environment and provides solutions for sustainable design. One topic covers the principle of expert witness reports for legal cases.

MECH ENG 4142A

Design Project Pt A

3 units - semester 1

Up to 48 hours lectures, 20 hours individual supervision, 180 hours project

Available for Non-Award Study

Assessment: Prelimary Report, exhibition, seminar, final report, assignments

The aim of the project is to provide solutions to engineering problems related to industry or to school research, with a primary emphasis on engineering design. Students will be taught and learn through self directed research, the engineering issues of personnel and resource management, project and business management, risk management and the legal aspects pertaining to engineering businesses. The course will cover the principles of quality management and continual improvement, including: Justification for quality management and continual improvement, Overview of quality management system types, TQM, Lean Systems and The Six-Sigma Process, Advanced Product Quality Planning, Design Failure Mode Effect Analysis (DFMEA), Process Failure Mode Effect Analysis (PFMEA), Design Verification Plan and Report (DVP&R) and Case Studies.

MECH ENG 4142B

Design Project Pt B

9 units - full year

Up to 48 hours lectures, 20 hours individual supervision, 180 hours project

Available for Non-Award Study

Assessment: Prelimary report, exhibition, seminar, final report, assignments

The aim of the project is to provide solutions to engineering problems related to industry or to school research, with a primary emphasis on engineering design. Students will be taught and learn through self directed research the engineering issues of personnel and resource management, project and business management, risk management and the legal aspects pertaining to engineering businesses. The course will cover the principles of quality management and continual improvement, including: Justification for quality management and continual improvement, Overview of quality management system types, TQM, Lean Systems and The Six-Sigma Process, Advanced Product Quality Planning, Design Failure Mode Effect Analysis (DFMEA), Process Failure Mode Effect Analysis (PFMEA), Design Verification Plan and Report (DVP&R) and Case Studies.

MECH ENG 4142C

Design Project Pt C

6 units - full year

Up to 48 hours lectures, 20 hours individual supervision, 180 hours project

Pre-Requisite(s): MECH ENG 4116

Assessment: Preliminary report, exhibition, seminar, final report, assignments

The aim of the project is to provide solutions to engineering problems related to industry or to school research, with a primary emphasis on engineering design. Students will be taught and learn through self directed research the engineering issues of personnel and resource management, project and business management, risk management and the legal aspects pertaining to engineering businesses. The course will cover the principles of quality management and continual improvement, including: Justification for quality management and continual improvement, Overview of quality management system types, TQM, Lean Systems and The Six-Sigma Process, Advanced Product Quality Planning, Design Failure Mode Effect Analysis (DFMEA), Process Failure Mode Effect Analysis (PFMEA), Design Verification Plan and Report (DVP&R) and Case Studies.

MECH ENG 4143A

Honours Project Pt A

3 units - semester 1

Up to 48 hours lectures/tutorials, 20 hours individual supervision, 180 hours project

Available for Non-Award Study

Assessment: Preliminary report, exhibition, seminar, final report, assignments

The aim of the project is to provide solutions to engineering problems related to industry or to school research, with a primary emphasis on engineering design. Students will be taught and learn through self directed research the engineering issues of personnel and resource management, project and business management, risk management and the legal aspects pertaining to engineering businesses. The course will cover the principles of quality management and continual improvement, including: Justification for quality management and continual improvement, Overview of quality management system types, TQM, Lean Systems and The Six-Sigma Process, Advanced Product Quality Planning, Design Failure Mode Effect Analysis (DFMEA), Process Failure Mode Effect Analysis (PFMEA), Design Verification Plan and Report (DVP&R) and Case Studies.

MECH ENG 4143B

Honours Project Pt B

9 units - full year

Up to 48 hours lectures/tutorials, 20 hours individual supervision, 180 hours project

Available for Non-Award Study

Assessment: Preliminary report, exhibition, seminar, final report, assignments

The aim of the project is to provide solutions to engineering problems related to industry or to school research, with a primary emphasis on engineering design. Students will be taught and learn through self directed research the engineering issues of personnel and resource management, project and business management, risk management and the legal aspects pertaining to engineering businesses. The course will cover the principles of quality management and continual improvement, including: Justification for quality management and continual improvement, Overview of quality management system types, TQM, Lean Systems and The Six-Sigma Process, Advanced Product Quality Planning, Design Failure Mode Effect Analysis (DFMEA), Process Failure Mode Effect Analysis (PFMEA), Design Verification Plan and Report (DVP&R) and Case Studies.

MECH ENG 4143C

Honours Project Pt C

6 units - full year

Up to 48 hours lectures/tutorials, 20 hours individual supervision, 180 hours project

Assessment: Preliminary report, exhibition, seminar, final report, assignments

The aim of the project is to provide solutions to engineering problems related to industry or to school research, with a primary emphasis on engineering design. Students will be taught and learn through self directed research the engineering issues of personnel and resource management, project and business management, risk management and the legal aspects pertaining to engineering businesses. The course will cover the principles of quality management and continual improvement, including: Justification for quality management and continual improvement, Overview of quality management system types, TQM, Lean Systems and The Six-Sigma Process, Advanced Product Quality Planning, Design Failure Mode Effect Analysis (DFMEA), Process Failure Mode Effect

Analysis (PFMEA), Design Verification Plan and Report (DVP&R) and Case Studies.

MECH ENG 4144

Renewable Fluid Power Technology

3 units - semester 1

Up to 4 hours per week, plus 1 practical of 5 hours

Assumed Knowledge: MECH ENG 2021, MECH ENG 3105, MECH ENG 3102 & MECH ENG 3101

Assessment: Assignments 40%, final exam 60%

This course gives an overview of the historical background and development of the wind, wave, hydro and tidal power technology. Present day usage and their potentials are also discussed. It then demonstrates the application of fundamental fluid mechanics principles to basic aerodynamics and hydrodynamics, as well as to deterministic wave theories in deep and shallow water to describe the technological process of the generation of renewable energy from these different sustainable resources. Basic concepts and various components of the power generation technology are also studied in order to be able to design, assess and compare different sustainable power generation alternatives with respect to economic and environmental impacts.

MECH ENG 4145

Sustainable Thermal Technologies

3 units - semester 1

Up to 3 hours per week, plus 2 practicals of 5 hours each

Assumed Knowledge: MECH ENG 2021

Assessment: Assignments 40%, final exam 60%

This course gives an introduction and in depth overview of the working principles, basic theory and current development of typical sustainable thermal energy systems and technologies; eg. solar water heaters, solar thermal powered cooling, geothermal technologies, heat storage, waste heat recovery, cogeneration, hydrogen technologies and fuel cells etc. Broader issues, eg. energy efficiencies and costings, nuclear is a future (or not), and climate change, are discussed in the course as well.

Mining Engineering

MINING 1011

Introduction to Mining Engineering 1A

3 units - semester 2

48 hours lectures, practicals and a field trip

Restriction: BE(Mining) and associated double degrees only

Available for Non-Award Study

Assumed Knowledge: High school Physics & Maths

Assessment: site visit report 25%, quizzes (x2) 20%, assignment 15%, final exam 40%

This course provides a basic introduction to the fundamental operations involved in mining engineering. Topics to be covered include stages in the life of a mine, resources evaluation, mine planning and design, surface and underground mining methods, drilling and blasting, rock support systems, haulage and hoisting, mineral processing, mine safety and environment. Site visits to working mines during mid-tern break will also be included.

Part of the course will be devoted to framing and solving unstructured problems by discussing a variety of puzzles. Such educational puzzles are used to illustrate basic concepts of critical thinking, mathematics, and problem-solving.

MINING 3068

Mine Ventilation

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011 & C&ENVENG 2071

Assessment: Exams, laboratory reports and assignments

This course provides the theory and principles of mine ventilation involving the subsurface environment in underground mining operations. Topics covered include mine dust and gases, hazards and risks, mine fires, radiation, ventilation circuit design and analysis, ventilation surveys and monitoring, heat stress and other health and safety issues, current legislative requirements and operational standards, and management of mine ventilation systems.

MINING 3069

Rock Breakage

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011, C&ENVENG 3071 & C&ENVENG 3072

Assessment: Exam, assignments and quizzes

Introduction to rock fragmentation theory and blasting theory; drilling equipment and drilling system selection; types of explosives and their selection; detonating devices and their applications; pattern design for drilling and blasting.

MINING 3070

Resource Estimation

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011, MATHS 2201 & GEOLOGY 2009

Assessment: Exams, assignments, group projects

Mine geology. Resource and reserve estimation of coal and metalliferous deposits. Sampling methodology. Reporting resources & reserves, with particular reference to the JORC code. Various estimation methods & their relevance to specific mineral deposits. Ore body and block modeling. Geostatistics

MINING 3071

Mining Systems

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011

Assessment: Exams and assignments

This course provides an overview of the principles and application of the major underground and surface mining methods and equipment, and the conceptual design of the major materials handling and transport systems and support infrastructure. Specific topics to be covered include: Surface mining methods; Underground mining methods; materials handling and transport systems; Systems infrastructure and site requirement.

MINING 3072

Mining Geomechanics

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1010, GEOLOGY 1104 & C&ENVENG 2025

Assessment: Exams, laboratory report and assignments

This course aims to provide students with the basic knowledge required to undertake geotechnical investigations. The topics covered in the course include: Basics of materials behaviour; stress-strain, failure criteria, stress and strain tensors. Basic Rock Mechanics rock material behaviour, joints, rock mass strength and deformability

MINING 3073

Mine Planning

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011, C&ENVENG3070 & C&ENVENG 3071

Assessment: Exams and assignments

This course deals with the theoretical principles and practical methodologies associated with mine planning. Mine planning is an iterative process entailing elements of design, scheduling and evaluation. As part of the planning process a range of issues has to be considered including, short and long term planning, mine optimisation, cut-off grade analysis and mining valuation. The course presents principles of surface and underground mine planning and valuation for metaliferous and coal mining projects.

MINING 3074

Special Topics in Mining Engineering

3 units - semester 1 or semester 2

Up to 4 hours per week

Available for Non-Award Study

Assessment: To be advised at beginning of semester

Special Topics in Mining Engineering

MINING 4100A

Mining Research Project Pt A

Available for Non-Award Study

Pre-Requisite(s): Students must enrol in Part A in semester prior to Part B

Co-Requisite(s): MINING 4100B

MINING 4100B

Mining Research Project Pt B

6 units - full year

120 hrs directed study

Restriction: Available to BE(Mining) and associated double degree students only

Pre-Requisite(s): MINING 4100A

Assumed Knowledge: 24 units at Levels I, II and III must be completed before entering Level IV except by permission of Head of Discipline

Assessment: Conference paper, Research report, oral presentation

Students work in groups on a research project under the supervision of an academic staff member. Key steps include the production of a research proposal which includes a critical literature review, identification of appropriate research gaps, and a detailed methodology. All groups are expected to produce a safe work plan and liaise with staff, including laboratory personnel, as appropriate. The final outcomes are presented at a one day conference which includes the production of a printed proceedings.

MINING 4101

Mine Management

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011 & C&ENVENG 2068

Assessment: Exams, assignments, management game

Management of production, inventory, services, contracts, finance, sales and marketing, personnel, public relations; mining law; health, safety and risk management; environmental management; introduction to system engineering;

MINING 4102

Mine Geotechnical Engineering

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Mining) and associated double degree students only

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 2069, C&ENVENG 3071 & C&ENVENG 3072

Assessment: Exams and assignments

The course content includes the following components across the range of coal and metalliferous mining systems: core geotechnical risks inherent in major mining methods and risk management criteria; hazard recognition, mapping and ground control management plans; underground mining excavation design; rock mass classification; surface mining geomechanics; application of numerical stress analysis modelling; geotechnical instrumentation; pillar and roadway design; principles and practice in ground control; geotechnical role of mine fill systems; rock reinforcement principles and systems; subsidence engineering; roadway and pillar design; caving mechanics, outbursts, rockbursts, wind/airblasts. Case studies, group work and problem-based learning projects will form a major component of this course.

MINING 4104

Socio-Environmental Aspects of Mining

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011

Assessment: Exams and assignments

This course provides the future mining engineer with a comprehensive and practical understanding of the socio-environmental impacts both positive and negative that mining may have on society. Topics covered are: Legal & political context of mining in Australia, principles of sustainable development, company-based initiatives in environmental management, state of the art techniques in environmental management of mine sites, and major issues associated with social/community impacts of mining in Australia and internationally.

MINING 4105

Mineral Processing Engineering

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 1011

Assessment: Exams and assignments

mineral dressing and process metallurgy; comminution process - crushing and grinding; concentration techniques; flotation; introduction to pyrometallurgy, electrometallurgy and hydrometallurgy.

MINING 4106

Hard Rock Mine Design and Feasibility

3 units - semester 1

Up to 4 hours per week

Restriction: Available to BE(Mining) and associated double degree students only

Available for Non-Award Study

Assumed Knowledge: MINING 3073

Assessment: Technical merit of the design and feasibility study, report and oral presentations. Progress Interviews = 25%; Presentations = 25%; Final Report = 50%.

This course involves the development of a pre-feasibility study for a metalliferous mining project. Activities include: assessment of reserves, method selection, layout and optimisation of surface and underground operations, geotechnical design, ventilation design, project risk assessment, mine scheduling, equipment selection, cost estimation, economics / finance and sustainability. Students get to use industry standard mine design and optimisation software packages.

MINING 4107

Surface Mining Systems

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: C&ENVENG 3071

Assessment: Metal project = 50%; Coal project = 50%

This is an advanced course building on the learning acquired in the Mining Systems course. The students will have the opportunity to further develop their knowledge and skills in the selection and evaluation of surface coal and metaliferous mining systems using a project-based learning approach. This course assumes that students have a good understanding of mining terms and descriptions, have been exposed to surface and underground mining methods and are familiar with mining development, operations and production. Each project is undertaken by a group of 3-5 students.

MINING 4108

Underground Mining Systems

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: C&ENVENG 3071

Assessment: Metal project = 50%; Coal project = 50%

This course covers the principles and application of the major underground and surface mining methods, and the design of materials handling and transport systems and infrastructure required to support them.

Specific topics to be covered include: Surface mining methods; Underground mining methods; Materials handling and transport systems; Systems infrastructure and site requirement. Each project is undertaken by a group of 3-5 students.

MINING 4109

Mining in a Global Environment

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: C&ENVENG 4104

Assessment: Assignment = 20%; Group project = 50%; Examination = 30%

This course provides students with the tools necessary to meet the challenges of working for mining companies as mining engineers and managers in an international (and/or remote Australian) setting. The focus will be on developing countries and an aim will be to draw comparisons between the Australian and international contexts. The course will draw extensively on case studies. It will provide an international perspective of mining; governance and regulatory frameworks; financing; mining companies as agents of change; cross-cultural management; gender; small-scale mining; indigenous communities; health and safety issues; and the influence of China and India.

MINING 4110

Mine Asset Management & Services

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: MINING 3071

Assessment: Individual Assignment 1 = 30%; Group Assignments = 50%; Quizzes = 20%

Mine maintenance and services are responsible for between 40 and 70 percent of the operating cost of a surface mine, and 20 to 50 percent of the operating cost of an underground mine. The quality of maintenance programs affects the productive capacity of mining operations. In the course of their professional careers, Mining Engineers will fi nd themselves dealing with maintenance and service related issues such as: working with teams to de-bottleneck productive processes; preparing and checking maintenance budgets; administrating maintenance contracts; and deciding on mine dewatering or electrical distribution layouts. The course covers the principles of mine maintenance and services, including electrical and compressed air distribution, mine dewatering and mine communications. It covers the design of maintenance systems, including preventive, predictive, proactive and corrective maintenance methods, as well as basic reliability theory and models for optimising maintenance decisions

MINING 4111

Coal Mine Design and Feasibility

3 units - semester 2

Up to 4 hours per week

Restriction: Available to BE(Mining) and associated double degree students only

Available for Non-Award Study

Assumed Knowledge: MINING 3073

Assessment: Technical merit of the design and feasibility study, report and oral presentations. Progress Interviews = 30%; Presentations = 20%; Final Report = 50%.

The aim of this course is to introduce students to the principles of mine feasibility studies for coal mine deposit. In this course students should be able to develop skills for optimal mine design, scheduling

and preparation of a pre-feasibility study document. Students work in groups on a mine design and feasibility study project under the supervision of an academic staff member.

MINING 4112

Advanced Mine Geotechnical Engineering

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: C&ENVENG 4102

Assessment: Students are given a consulting project for a client; they collect data, perform numerical modelling and submit a professional report to the client.

This course offers students advanced techniques in rock mechanics. The focus of the course is on numerical modelling as applied to mine rock structures in the mining environment.

MINING 4113

Advanced Mine Ventilation

3 units - semester 2

Up to 4 hours per week

Assumed Knowledge: MINING 3068

Assessment: Mine ventilation design project, report and presentations

This course is concerned with advanced aspects of metalliferous and coal mine underground ventilation practice and environmental control. In addition to taking topics covered in the core Mine Ventilation course to a more advanced level, emphasis is also placed on operational aspects such as controlling complex mine ventilation networks and planning ventilation requirements to manage both safety and business related risks.

MINING 4114

Simulation & Animation for Mining Engineers

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: Basic statistics

Assessment: 2 exams (30%), major project (25%), final exam (45%)

Students will learn special simulation language (GPSS/H) and software to make animations. Mining operations will be highlighted. Actual mining examples from Australian mines will be used as case histories

Petroleum Engineering

PETROENG 1005

Intro to Petroleum Geosciences & the Oil Industry

3 units - semester 1

Up to 5 hours per week, plus field trip

Available for Non-Award Study

Assumed Knowledge: SACE stage 2 Maths Studies, Specialist Maths and Physics

Assessment: Selected prac exercises, Field camp report, theory exam

This course provides an introduction to geology (first half of the semester) and an introduction to the petroleum geosciences (second half of the semester). No prior knowledge in geology is assumed and the course starts from basic geological concepts (e.g. minerals, igneous rocks, sedimentary rocks, metamorphic rocks, rock deformation and geological time) then works onto the petroleum system (e.g. source rocks, reservoir rocks, sealing rocks, maturation, migration and trapping of hydrocarbons) and finally introduces the tools used in petroleum exploration (seismic surveying, drilling and logging). Throughout the semester one lecture per week is also given by a guest speaker from different sectors of the oil industry in order to provide an overview of the oil industry.

PETROENG 1006

Introduction to Petroleum Engineering

3 units - semester 2

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: SACE Stage 2 Maths Studies, Specialist Maths, Physics

Assessment: assignments, exam

The aim of the course is to provide students with a broad overview of introduction to petroleum engineering in order that advanced courses in subsequent years can be understood within a broader petroleum engineering context. This course covers introductions of: petroleum exploration, drilling, completion and production, reservoir mechanics, fundamentals of rock and fluid properties, composition and PVT properties of petroleum fluids; basic physical and chemical properties of petroleum reservoir fluids related to reservoir processes and production. It also provides an introduction to decision-making and the petroleum business environment.

PETROENG 2001

Reservoir Thermodynamics and Fluid Properties

3 units - semester 2

Lectures, practicals/labs

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assessment: assignments, exam

Fluid properties and the application of mass and energy balances to a variety of petroleum systems. Introduction to phase behaviour and chemical reaction equilibria (flash calculations with k-values); and equation of state applications and modelling.

PETROENG 2005

Sedimentology & Stratigraphy for Petrol Engineers

3 units - semester 2

Up To 4 hours per week plus 2 Saturday field trips

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assumed Knowledge: PETROENG 2009, PETROENG 2001, MATHS 2201

Assessment: practical class exercises, field trip write-ups, exam

The course covers applications of sedimentology and stratigraphy to petroleum exploration and development. It includes an introduction to sedimentary rocks, details of depositional environments (processes, structures and deposits), sequence stratigraphic methods of correlation, seismic stratigraphy and basic 3D reservoir modelling techniques. The class will undertake two field trips. This course is an essential introduction to sedimentology and stratigraphy for those wishing to become petroleum engineers

PETROENG 2009

Formation Evaluation, Petrophysics & Rock Props

3 units - semester 2

Lectures, tutorials/practicals

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assessment: in-class assignments, take home tasks, quiz, final assessment test in-class

The purpose of this theoretical and practical course is to introduce petrophysical and transport properties of rocks, methods of their determination in lab from cores and in oilfields from wireline logging.

This course gives abilities to determine main rock properties in lab and practical understanding of the interpretation of wire line tools and techniques, open and cased hole log analysis methods for the determination of lithology, porosity, fluid content and movement, and net pay. Both, qualitative (quick look) and quantitative analyses methods are covered. Practical examples are used throughout and case histories are used to demonstrate specific aspects. Several laboratory works are performed for coring with determination of rock properties.

PETROENG 2010

Drilling Engineering

3 units - semester 1

Up to 4 hours per week

Assumed Knowledge: Higher Maths, Physics, Chemistry, Fundamental laws of statics and dynamics, stress analysis, fluid flow through pipes and annulus

Assessment: Assignments, special report, lab report, exam

The aim of the course is to provide students with a fundamental understanding of petroleum well drilling procedures, its mechanics, and design methodology. The course gives an overview of drilling rig operations and related equipment; offshore drilling and advanced drilling tools; drill-string design; drill bit technology and optimization; drilling hydraulics; drilling mud design; cementation options and design; pore pressure and fracture pressure calculations; casing design; basic well control; well planning; directional drilling and well trajectory calculations.

PETROENG 3001

Reservoir Simulation

3 units - semester 2

Lectures, tutorials

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assumed Knowledge: MATHS 1012, MATHS 2201, MATHS 2104, PHYSICS 1100, PETROENG 2009

Assessment: in-class assignments, take home tasks, quiz, final assessment test in-class

The course gives the theoretical basis and practical fundamentals for numerical simulation and analytical modelling of fluid flow in petroleum reservoirs. The partial differential equations required for modelling of single-phase and multi-phase fluid flow in porous media are derived. The governing systems are used for development of several analytical models which serve for reservoir evaluation and analysis. A particular attention is given to empirical functions of transport properties and phase equilibrium that the models contain and which are input functions into reservoir simulators. The numerical methods for solving the basic governing equations using finite difference methods are presented. Input data requirements and applications of simulation models for history matching and prediction of field performance will be discussed. Practical applications are directed to commercial reservoir simulator Eclipse.

PETROENG 3005

Reservoir Characterisation and Modelling

3 units - semester 1

Intensive

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assumed Knowledge: Introductory petroleum geology, rock properties & formation evaluation, SACE Stage 2 Maths, basic probability and statistics, competency in Excel

Assessment: mid-course test, assignment, exam

The objective of this course is to teach the basic science, technology and related assumptions involved in carrying out an integrated reservoir characterisation study. It will prepare students to understand and interpret techniques that underlie commercial software (but will not teach software usage itself). The emphasis is on providing students with knowledge of a 'toolkit' for, but not a prescriptive approach to, the ultimate goal of constructing 3D static models.

The course has three main components. 1) Data sources, quality and analysis, including spatial analysis. 2) Generating 3D models of reservoir properties - classical gridding and mapping, kriging as a data-driven (variogram) form of classical mapping (estimation) and a means of data integration. Simulation techniques are introduced as a means of modelling uncertainty resulting from heterogeneity. 3) Scaling of grids and property models for the purpose of reservoir simulation is the final topic. The integration and application of all the major ideas is illustrated by a case study

PETROENG 3007

Well Testing and Pressure Transient Analysis

3 units - semester 1

Up to 5 hours per week

Available for Non-Award Study

Assessment: assignments, exam

Well test objectives and concepts; fluid flow equation and fundamental solution; classical methods: drawdown and buildup analyses, bounded reservoirs; gas well testing; type curves and derivatives; complex systems: multi-layer, dual-porosity, hydraulic fractures; interference and pulse testing; drill-stem testing; test design, equipment and operations

PETROENG 3019

Structural Geology and Seismic Methods

3 units - semester 2

Lectures, practicals

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assessment: assignments, exam

Structural Geology: Basic concepts of stress (resolving stresses and Mohr Circle) and rock failure (friction, Coulomb); present-day stresses from oil field data; implications for wellbore stability and water flooding; basic concepts of structural geology; faults; folds; structural traps and fault seal analysis. Seismic Methods: Principles of reflection seismology, such as wave propagation phenomena, and seismic velocity and resolution. Data acquisition and processing methods, mechanics of seismic interpretation. Velocity anomalies and depth conversion. Techniques for evaluating reservoir and fluid

properties, such as seismic attributes, DHIs and AVO, and time lapse seismology

PETROENG 3020

Production Engineering

3 units - semester 1

Up to 5 hours per week

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assumed Knowledge: MATHS 1012, PHYSICS 1100, C&ENVENG 1010, MECH ENG 2021

Assessment: Quizzes, assignments, project [written & oral presentation]

The aim of this course is to provide familiarization of the principles and applications of various theories and techniques necessary to design, estimate and maximize production performance in a cost effective manner within various constraints from the oil and gas well systems. Attempts will be made to understand how these techniques could be applied in a practical field development project to identify the best way of exploiting petroleum reserves, as well as maximizing ultimate production.

This course will address details of reservoir inflow performance, well flowing performance, design of artificial lift systems, familiarization of petroleum production facilities, and analysis and optimization of total petroleum production systems using conventional and nodal analysis.

Students will also be given opportunity to apply these theories and methods through numerical problem based exercises and practical project assignments. The project assignment may require the use of a commercial simulator.

PETROENG 3023

Well Completion and Stimulation

3 units - semester 2

Up to 5 hours per week

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Pre-Requisite(s): PETROENG 2010

Assumed Knowledge: Higher Maths, Physics, Chemistry

Assessment: Assignments, exams

The objective of this course is to provide students the broad understanding of petroleum well completion process. The course covers the fundamental principles of the design and evaluation of well completions, casing design in various loading condition with various downhole situations; placement of casing, liners and well tubing; cementing techniques; perforation techniques; gravel packing; sand control and measurement, use of different sand control devices; fundamentals of fracturing including acid fracturing and hydraulic fracturing;and matrix acidizing This course also covers the broad overviews of various completion techniques, tools, and wellhead types, and surface gathering systems.

PETROENG 3025

Reservoir Engineering

3 units - semester 2

Lectures, tutorials, lab demo

Assumed Knowledge: PETROENG 1005, PETROENG 1006, PETROENG 2001, PETROENG 2005, PETROENG 2009, MATHS 1012, PHYSICS 1100

Assessment: Exam, assignments

Darcy's Law and Applications, Concepts of permeability, Relative permeability, Capillary pressure, Wettability, Material Balance Equations for Different Types of Reservoirs and Drives, Aquifer Behaviour and Water Influx, Immiscible Displacement, Buckley-Leverett theory, Gravity-Stable Displacement, Water and Gas Injection, Coning and Cusping, Decline Curve Analysis, Reservoir and wellbore deliverability..

PETROENG 3026

Formation Damage and Productivity Enhancement

3 units - semester 1

Lectures, tutorials

Pre-Requisite(s): MATHS 1012

Assumed Knowledge: MATHS 1012, MATHS 2201, MATHS 2104, PHYSICS 1100, PETROENG 2009

Assessment: In-class assignments, take home tasks, quiz, Final assessment test in-class

The course covers transport of colloids/suspensions in natural reservoirs and its applications to formation damage in injection and production wells, its prediction, mathematical and laboratory modelling, prevention and mitigation. The oil-production processes covered are injectivity decline, re-injection of produced water, invasion of drilling fluid, sand production, gravel pack, sand screens, fines migration, disposal of produced water, IOR. The physics phenomena caused damage include deep bed filtration, external filter cake formation, precipitation of salts, ashpaltenes and paraffines, fines migration and liberation, rock deformation and compaction, two-phase flow of suspensions and colloids. Cases of vertical, horizontal, fractured and perforated wells are discussed. Techniques of damage removal and well stimulation are presented.

The lectures are accompanied by numerous training exercises and field examples

PETROENG 4002

Enhanced Oil Recovery

3 units - semester 2

Intensive

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assumed Knowledge: MATHS 1012, PHYSICS 1100, PETROENG 1001 or PETROENG 1006, PETROENG 2001, PETROENG 2005, PETROENG 2009, PETROENG 3005, PETROENG 3025

Assessment: assignments, exam

This course will cover theory and applications of various EOR processes. Also, students will be exposed to IOR techniques. Application aspects will be demonstrated through exercises and large assignments

PETROENG 4004A/B

Petroleum Engineering Honours Project Part 1 & 2

6 units - full year

Up to 20 hours per week

Restriction: Available only to students admitted to the relevant Honours program

Assessment: major research/study assignment & written report, presentation of project - students are expected to work a minimum four weeks on projects

Honours students will choose a research project from a list of available topics. A written report and an oral presentation is expected at the conclusion of various projects. The honours projects

are intended to give students a taste for research and will prepare them in part to carry on their studies for a higher degree.

PETROENG 4020A/B

Petroleum Engineering Design Project Part 1 & 2

6 units - full year

Up to 20 hours per week

Restriction: Available to BE(Petroleum) students only

Assessment: major research/study assignment & written report, presentation of project

Students will be assigned a group design project using available field data. A written report and an oral presentation are expected at the conclusion of the project. Students are expected to work a minimum of eight weeks on their projects.

PETROENG 4022

Integrated Field Development and Economics Project

3 units - semester 2

Lectures, tutorials

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assessment: assignments, project (written & oral presentation)

Field Development Planning for oil and gas fields, gives an overview of the process and methods for developing an optimum plan for developing a petroleum deposit. Key project drive indicators are discussed and it is shown how various disciplines interact in their quest for maximising the value of a project. The course covers all aspects of field development planning, commencing with screening studies, after discovering hydrocarbons, to project sanction. In particular, it is shown that this development phase has the potential to add maximum value, when compared to all other phases of the life cycle, as such it is most critical. Critical aspects are presented in detail in terms of actual case histories. It is shown how a proper balance has to be struck among key elements: reservoirs, wells and facilities, not to mention the balance between minimising costs and maximising recovery. Other key essentials, such as flexibility and risk management are also covered.

The project is based on an actual data set involving an offshore project. The aim is to study the exploration results and to develop a recommendation for the optimum field appraisal plan. When the actual plan and data is revealed, the second part of the project involves the feasibility and derivation of the optimum development plan. Participants work in small teams and have to submit written plans and give presentations in front of a panel.

PETROENG 4027

Decision Making and Risk Analysis

3 units - semester 1

Intensive

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assumed Knowledge: Introductory petroleum geology, rock properties & formation evaluation, SACE Stage 2 Maths, basic probability and statistics, competency in Excel

Incompatible: PETROENG 4024, PETROENG 7009 or PETROENG 7049

Assessment: mid-course test, assignment, exam

This course teaches the skills required for a key management role - creating value by making decisions that yield optimal returns on the allocation of human and financial resources. The many uncertainties inherent to the oil and gas business (estimating current 'states-of-the world/nature' and predicting future events) create considerable uncertainty in the value that can be realised from resource-allocation decisions. Consequently, there will be a strong emphasis on evaluating the impacts of uncertainty, managing its resultant risks and planning to exploit its up-side potential. Topics to be addressed are the decision-making process, multi-objective decision making, decision-tree analysis, decision criteria, Monte Carlo Simulation and Value of Information & Flexibility. In addition, Utility Theory will be introduced as a means of rationally accounting for risk attitudes and some of the psychological and judgemental aspects of how people respond to uncertainty will be discussed. The techniques learned in this course will also be useful in making personal decisions.

PETROENG 4033

Integrated Reservoir & Project Management

3 units - semester 1

Intensive

Available for Non-Award Study

Assumed Knowledge: Reservoir Geology, Material Balance and Decline Curve Analysis, Reserves Estimation, Reservoir Geophysics, Reservoir Drive Mechanisms, Reservoir Surveillance, Formation Evaluation, Well Performance, Fluid Evaluation, Development Planning

Incompatible: PETROENG 4028 & PETROENG 4009

Assessment: assignments, group discussion, exams

This course will be comprised of 2 short course components; Project Management and Integrated Reservoir Management.

Project Management outlines the necessary management processes and control methods required for the successful management of resources, budgets and costs, and schedule. Project management covers all major elements of project management, with emphasis on delivering a project in budget and on time. Areas covered will include an overview of project management, project initiation, project plan development, project execution and delivery, monitoring and control and project closeout. Key concepts, terms and principles of project management and project management methodology for the whole life cycle of a project will be covered. Students will learn to plan projects, handle multiple stakeholders, build a Work Breakdown Structure, estimate resources, optimise schedules, quality control, manage stakeholder communications, risk planning, tracking and reporting of project status. Students will also gain an appreciation of the roles and skills of the project manager and all team members.

Integrated Reservoir Management aims at bringing together learnings from geology, geophysics, formation evaluation reservoir engineering, wellbore engineering and surface facilities engineering. It will discuss a wide variety of reservoir description, surveillance, interpretation, studies, reserves determination, production forecasting and operational considerations which together constitute Integrated Reservoir Management. It focuses on providing a basis for practical development and implementation of Integrated Reservoir Management and Reserves Optimisation programs with emphasis on cost effectiveness and economic justification.

PETROENG 4034

Petroleum Business and Project Economics

3 units - semester 2

Intensive

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Assumed Knowledge: Introductory petroleum geology and engineering, competency in Microsoft Excel

Incompatible: PETROENG 3002 & PETROENG 4031

Assessment: mid-course test, assignment, exam

Petroleum engineers perform technical work to support the "business" objectives of the organization they work for (corporation, government). It is therefore important that they understand that "business" because it will influence the judgments they make. Economic evaluations provide the main source of the organization's information by which investment and operational decisions are made regarding the most effective use of resources. There are many subtleties and assumptions that underlie the apparently straight-forward calculations that are often seen. Consequently, a fundamental understanding of the concepts behind economic evaluation and of techniques for performing them within a petroleum context, are essential skills. Topics to be included are: economic and business concepts, cash-flows and petroleum fiscal regimes, time-value of money, discounted cash flow, net present value and other economic metrics, case study and portfolio management. If time permits, there will be an introduction to real options analysis and its application to valuing flexibility and risk.

PETROENG 4035

Reservoirs, Resources and Reserves

3 units - semester 1

Intensive - 49 hrs over 8 days

Restriction: Available to BE(Petroleum) students only

Available for Non-Award Study

Incompatible: PETROENG 4007, PETROENG 4003 & PETROENG 4032

Assessment: assignments, group discussion, exam

This course comprises 2 components; Reservoir Geology and Resources & Reserves.

This course provides participants with a working knowledge of the main techniques (qualitative and quantitative), used by Reservoir (Development and Production) geologists to evaluate subsurface properties of hydrocarbon reservoirs. Geological controls on well log signaturesporosity, permeability, relative permeability, and capillarity are discussed. Case histories review conventional methods of determination of net pay and demonstrate some improved techniques using data from core, sidewall core, cuttings, conventional plug measurements (porosity and permeability) in conjunction with capillary pressure data. The course focus will be on conceptual understanding and practical applications using case studies and hands-on exercises.

This course also explains strength and weaknesses of various reserves estimating methodologies, including differences between resources and reserves and differences between reserve estimates used for regulatory reporting and those used for business decision making. Exploration and development views are covered, as are deterministic and probabilistic methods, with the aim of gaining a thorough understanding of various reserves levels and their equivalence in both systems, in terms of proved, proved plus probable, and proved plus probably plus possible. Alternative estimation methods, such as volumetrics, material balance and decline curve analysis. An appreciation will be gained of data limitations and uncertainty and how this is reflected in final volumes and hence risk.

PETROENG 4036

Carbon Capture and Storage

3 units - summer semester

Intensive - 40 hours over 5 days

Available for Non-Award Study

Assessment: Group Project presentations, class participation, in-class exercises

This course will cover the following topics:

1. Carbon dioxide emission reduction: Climate change and carbon dioxide, Greenhouse gases, Stationary and non-stationary sources, Emissions around the world, Emitting industries - CCS potential, CCS as a greenhouse gas emission reduction measure, Overview of carbon capture and storage (CCS).
2. Principles of CO2 Storage: Geological storage systems, Reservoirs, seals and traps, Migration pathways, Geochemistry and hydrodynamics.
3. CO2 Capture: Fuel types and emission sources, Combustion processes - conventional and low emission, Natural gas separation, Industrial applications.
4. CO2 capture technologies: Capture technologies, Solvent, Membrane, Adsorbent, Emerging technologies.
5. Finding CO2 storage sites: Site characterisation, Reservoir characterisation, Modelling and simulation, Drilling & Injection, Long-term fate of CO2, Monitoring and verification.
6. Compression and transport of CO2, Compression, Methods of transport - overview, Pipeline transport.
7. Economics of CCS: Measuring the effectiveness of CCS, Calculating CCS costs, Source to sink matching, Emissions trading schemes.
8. Health, safety and risk and regulation: Safety of carbon dioxide, Risk assessment and management, Community and CCS, Legal frameworks for CCS, Overseas legislation, Australian legislation.

Petroleum Geology and Geophysics

PETROL 4000A/B

Honours Petroleum Geology and Geophysics Part 1 & 2

24 units - full year

Restriction: Available only to students admitted to the relevant Honours program

Assessment: Formal written & oral assessments, marked practical exercises, assignments & seminars - coursework and project thesis

The program comprises three components:

a. set of short courses presented back-to-back, commencing in late February. This provides a thorough grounding in the many facets of petroleum geoscience. Details can be found at www.asp.adelaide.edu.au
b. six-week internship in the petroleum industry, normally commencing in late June. The number of internship places available varies from year to year, and cannot be guaranteed for every student. If there are more students than internship places, these places will be allocated based on merit; alternate internship/research projects will be provided within the ASP for students without an industry internship.
c. supervised individual research project, which is written up as a thesis, and submitted in early November. Work done during the internship usually forms the basis of the thesis.

Depending on the nature of their previous studies and experience, coursework exemptions, substitutions or additions may be granted or required for some students. Intending students must apply before the end of the year preceding that in which they wish to enrol.

Pure Mathematics

PURE MTH 2106

Algebra

3 units - semester 1

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2004

Incompatible: PURE MTH 2002

Assessment: ongoing assessment 30%, exam 70%

Knowledge of group theory and of linear algebra is important for an understanding of many areas of pure and applied mathematics, including advanced algebra and analysis, number theory, coding theory, cryptography and differential equations. There are also important applications in the physical sciences.

Topics covered are (1) Equivalence relations (2) Groups: subgroups, cyclic groups, cosets, Lagrange's theorem, normal subgroups and factor groups. Examples of finite and infinite groups, including groups of symmetries and permutations, groups of numbers and matrices. Homomorphism and isomorphism of groups. (3) Linear algebra: vector spaces, bases, linear transformations and matrices, subspaces, sums and quotients of spaces, dual spaces, bilinear forms and inner product spaces, and canonical forms.

PURE MTH 3002

Topology and Analysis III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: MATHS 2100

Incompatible: PURE MTH 3013

Assessment: ongoing assessment 30%, exams 70%

Solving equations is a crucial aspect of working in mathematics, physics, engineering, and many other fields. These equations might be straightforward algebraic statements, or complicated systems of differential equations, but there are some fundamental questions common to all of these settings: does a solution exist? If so, is it unique? And if we know of the existence of some specific solution, how do we determine it explicitly or as accurately as possible? This course develops the foundations required to rigorously establish the existence of solutions to various equations, thereby laying the basis for the study of such solutions. Through an understanding of the foundations of analysis, we obtain insight critical in numerous areas of application, such areas ranging across physics, engineering, economics and finance.

Topics covered are: sets, functions, metric spaces and normed linear spaces, compactness, connectedness, and completeness. Banach fixed point theorem and applications, uniform continuity and convergence. General topological spaces, generating topologies, topological invariants, quotient spaces. Introduction to Hilbert spaces and bounded operators on Hilbert spaces.

PURE MTH 3003

Number Theory III

3 units - not offered in 2011

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assessment: ongoing assessment 30%, exam 70%

Number theory is one of the oldest branches of mathematics. It is concerned with the properties of numbers, especially the properties of the integers. Historically, it was valued as the purest form of mathematics, but in fact there are many modern applications to information technology and cryptography. Number theory is a fundamentally useful course for any mathematician, but it also attracts a general audience because of its intrinsic beauty and its emphasis on problem-solving.

Topics covered are: Divisibility and primes, congruences, arithmetic functions, continued fractions and rational approximation, quadratic residues, and primitive roots. Examples of diophantine equations. Modern applications to computer science, cryptography etc. Introduction to number-theoretic computer packages.

PURE MTH 3007

Groups and Rings III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: PURE MTH 2002 or PURE MTH 2106

Incompatible: PURE MTH 3000 or PURE MTH 3011

Assessment: ongoing assessments 30%, exam 70%

The algebraic notions of groups and rings are of great interest in their own right, but knowledge and understanding of them is of benefit well beyond the realms of pure algebra. Areas of application include, for example, advanced number theory; cryptography; coding theory; differential, finite and algebraic geometry; algebraic topology; representation theory and harmonic analysis including Fourier series. The theory also has many practical applications including, for example, to the structure of molecules, crystallography and elementary particle physics.

Topics covered are: (1) Groups, subgroups, cosets and normal subgroups, homomorphisms and factor groups, products of groups, finitely generated abelian groups, groups acting on sets and the Sylow theorems. (2) Rings, integral domains and fields, polynomials, ideals, factorization in integral domains and unique factorization domains.

PURE MTH 3009

Integration and Analysis III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: PURE MTH 2003, MATHS 2100, or PURE MTH 3002

Assessment: ongoing assessment 30%, exam 70%

The Riemann integral works well for continuous functions on closed bounded intervals, but it has certain deficiencies that cause problems, for example, in Fourier analysis and in the theory of differential equations. To overcome such deficiencies, a "new and improved" version of the integral was developed around the beginning of the twentieth century, and it is this theory with which this course is concerned. The underlying basis of the theory, measure theory, has important applications not just in analysis but also in the modern theory of probability.

Topics covered are: Set theory; Lebesgue outer measure; measurable sets; measurable functions. Integration of measurable functions over measurable sets. Convergence of sequences of functions and their integrals. General measure spaces and product measures. Fubini and Tonelli's theorems. Lp spaces. The Radon-Nikodym theorem. The Riesz representation theorem. Integration and differentiation.

PURE MTH 3012

Fields and Geometry III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: PURE MTH 2106

Assessment: ongoing assessment 30%. exam 70%

This first part of this course generalizes the real numbers to a mathematical structure called a field. Finite fields have many applications, particularly in Information Security where the understanding of finite fields is fundamental to many codes and cryptosystems. Properties and constructions of fields will be investigated in detail. The second part of the course considers projective geometries. Projective geometry is one of the important modern geometries introduced in the 19th century. Projective geometry is more general than our usual Euclidean geometry, and it has useful applications in Information Security, Statistics, Computer Graphics and Computer Vision. The focus of this course will be primarily on projective planes.

Topics covered are: (I) Fields: fields, polynomials rings, extensions of fields; automorphisms of fields, the structure of a finite field. (II) Projective Geometry: projective planes, homogeneous coordinates, field planes, collineations of projective planes, conics in field planes, projective geometry of general dimension.

PURE MTH 3018

Coding and Cryptology III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: Students who have not completed any of PURE MTH 2000, PURE MTH 2002 or PURE MTH 2106 should see the Pure Mathematics Head of Discipline

Incompatible: PURE MTH 3006

Assessment: ongoing assessment 30%, exam 70%

The fundamental objective of cryptology is to enable communication over an insecure channel in such a way that an eavesdropper cannot understand what is being said. Classical cryptosystems required participants to share a common key. The new public key systems removed the need to share a private key. Coding theory is concerned with finding efficient schemes by which digital information can be coded for reliable transmission through a noisy channel. Error correcting codes are widely used in applications such as transmission of pictures from deep space, storage of data on CDs and design of identification numbers.

Topics covered in Cryptography are: classical cryptosystems; cryptanalysis: the different types of attack on these systems; Shannon's theory of perfect secrecy; unconditional and computational security; perfect secrecy. Public key cryptography: the RSA method and the El-Gamal cryptosystem and the mathematical problems on which they are based; digital signature schemes; the DES and AES cryptosystems.

Topics covered in Codes are: maximum likelihood decoding, symmetric channels, minimum distance of a code, error correcting capabilities of a code; Linear Codes: the generator and parity check matrix, the dual of a code; bounds on codes; syndrome decoding. Perfect codes: sphere packing bound, Hamming codes. Cyclic codes.

PURE MTH 3019

Complex Analysis III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: MATHS 2101 or MATHS 2202

Incompatible: PURE MTH 2001

Assessment: ongoing assessment 30%, exam 70%

When the real numbers are replaced by the complex numbers in the definition of the derivative of a function, the resulting complex-differentiable functions turn out to have many remarkable properties not enjoyed by their real analogues. These functions, usually known as holomorphic functions, have numerous applications in areas such as engineering, physics, differential equations and number theory, to name just a few. The focus of this course is on the study of holomorphic functions and their most important basic properties.

Topics covered are: Complex numbers and functions; complex limits and differentiability; elementary examples; analytic functions; complex line integrals; Cauchy's theorem and the Cauchy integral formula; Taylor's theorem; zeros of holomorphic functions; Rouche's Theorem; the Open Mapping theorem and Inverse Function theorem; Schwarz' Lemma; automorphisms of the ball, the plane and the Riemann sphere; isolated singularities and their classification; Laurent series; the Residue Theorem; calculation of definite integrals and evaluation of infinite series using residues; Montel's Theorem and the Riemann Mapping Theorem.

PURE MTH 3022

Geometry of Surfaces III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or 2105

Assumed Knowledge: MATHS 2101 or MATHS 2202

Assessment: assessment 30%, exam 70%

The geometry of surfaces is a classical subject which remains important today in fields as diverse as string theory and nano-materials. From a mathematical perspective it provides an excellent introduction to the ideas of contemporary Riemannian geometry.

Topics covered are:

The inverse and implicit function theorems; submanifolds of R^n; differential forms; Stokes'.

Theorem for submanifolds of R^n. Curvature of curves and surfaces in R3; geodesics.

The Gauss-Bonnet theorem.

Surfaces of zero gaussian curvature; minimal surfaces.

PURE MTH 4005A/B

Honours Pure Mathematics Part 1 & 2

24 units - full year

Restriction: Available only to students admitted to the relevant Honours program

Assessment: Exams for each course at end of semester in which it is offered, project, seminar

Students are required to obtain the approval of the Head of Mathematical Sciences before enrolling in the program, and should preferably consult with the Head before enrolling for Level III. Candidates may apply to the Head for permission, under certain circumstances, to take Honours over two years.

Students select from lecture courses offered by the School of Mathematical Sciences and other Schools as may be agreed to by

Head of Mathematical Sciences. Students may be allowed to take appropriate Level III Mathematical Sciences courses not already taken.

Students are assigned a supervisor to advise on and approve their lecture program and give guidance in writing a project on a Pure Mathematics topic. Possible topics should be discussed with staff during the preceding year.

Science and Technology Commercialisation

TECHCOMM 2000

Project Management for New Ventures

3 units - not offered in 2011

Intensive lectures, tutorials and practicals

Restriction: At least 2 years full time UG study or equiv

Available for Non-Award Study

Pre-Requisite(s): At least 2 years full time undergraduate study

Assessment: Individual assignment, practicals, exam

Types and importance of project plans; Project Manager's responsibilities, goals and success factors; Microsoft Project; charts and other tools; time, money and quality relationships.

TECHCOMM 2001

Foundations of Entrepreneurship

3 units - semester 1 or winter semester

Up to 4 hours per week

Available for Non-Award Study

Pre-Requisite(s): At least 24 units of undergraduate study

Assessment: individual assignment 30%, team project 30%, exam 40%

The nature and importance of entrepreneurship; forms of entrepreneurship; the entrepreneurial process; the entrepreneurial mind; creativity, ideas and innovation; screening entrepreneurial opportunities; identifying resources to support entrepreneurial activities; intellectual property issues; accessing finance and other resources; the entrepreneurial team; assessing risk; business structure and ethics; entrepreneurial strategy; finding and reaching customers and marketing innovation; feasibility planning.

TECHCOMM 2001NA

Foundations of Entrepreneurship

3 units - quadmester 1 or quadmester 3

The nature and importance of entrepreneurship; forms of entrepreneurship; the entrepreneurial process; the entrepreneurial mind; creativity, ideas and innovation; screening entrepreneurial opportunities; identifying resources to support entrepreneurial activities; intellectual property issues; accessing finance and other resources; the entrepreneurial team; assessing risk; business structure and ethics; entrepreneurial strategy; finding and reaching customers and marketing innovation; feasibility planning.

TECHCOMM 2005

Entrepreneurial Strategy and Resourcing

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

The strategy concept; Strategic decision making; Forming and formulating strategy; Organisational structure; The entrepreneurial strategic context; The innovative strategic concept; Managing change; Debt and equity financing as strategic decisions; The forms and sources of non-financial resources.

TECHCOMM 2005NA

Entrepreneurial Strategy and Resourcing

3 units - quadmester 1

The strategy concept; Strategic decision making; Forming and formulating strategy; Organisational structure; The entrepreneurial strategic context; The innovative strategic concept; Managing change; Debt and equity financing as strategic decisions; The forms and sources of non-financial resources.

TECHCOMM 2006

Opportunity Assessment

3 units - semester 1

Available for Non-Award Study

Developing an opportunity assessment programme; Assessing potential success of a number of possible opportunities; Risk analysis of commercialisation of innovation; Assessing technological innovations; Assessing market and financial issues of commercialisation; Constructing and communication of conclusions.

TECHCOMM 2006NA

Opportunity Assessment

3 units - quadmester 2

Available for Non-Award Study

Developing an opportunity assessment programme; Assessing potential success of a number of possible opportunities; Risk analysis of commercialisation of innovation; Assessing technological innovations; Assessing market and financial issues of commercialisation; Constructing and communication of conclusions.

TECHCOMM 3000

Innovation and Creativity

3 units - semester 1 or winter semester

Intensive: 13 hours lectures, 26 hours tutorial, 6 hours workshop

Available for Non-Award Study

Pre-Requisite(s): At least 2 years full time undergraduate study

Assumed Knowledge: TECHCOMM 2001

Individual and group creativity; barriers to creativity and approaches for overcoming these; methods for generating or recognising ideas, alternatives or possibilities to solve commercial or operational problems; turning creativity into innovation that benefits the customer and the business venture; bringing creativity and innovation into the organisation and building an environment to support these activities; creative scenarios for the future for the organisation.

TECHCOMM 3001

New Venture Planning

3 units - semester 2

Intensive: Lectures and practicals

Available for Non-Award Study

Pre-Requisite(s): At least 2 years full time undergraduate study

Assessment: Individual assignments, group project, journal

Project management principles and practice; foresight and forecasting methodologies; types of business plans and their uses;

financial, marketing and operational aspects of an innovation plan; strategic analysis of innovation and identification of opportunities.

TECHCOMM 3002

Applied Entrepreneurship

3 units - semester 2

The aim of this course is to enable students from a variety of backgrounds to gain experience and develop their knowledge in entrepreneurship into practical skills. The course will assist in the development of interpersonal skills, analytical ability, and business acumen.

Objectives:

On completion of this course, students should be able to; Demonstrate an understanding of how entrepreneurship and innovation impacts organisations: Demonstrate an ability to operationalise a business plan; Have the confidence to develop their own business venture or advise others who are doing so

Syllabus:

This syllabus is an application of the syllabus in the prerequisite courses. Three hours per week working with an existing entrepreneurial business

TECHCOMM 3003

Ethics and Cultural Aspects of Entrepreneurship

3 units - semester 2

The aim of this course is to enable students from a variety of backgrounds to understand different ethical and cultural backgrounds and how they impact on the decision making process of entrepreneurs. The course will explore the effect that ethics and culture has on entrepreneurs and entrepreneurial activity and how effective decision making is enhanced by an understanding of these differences.

Objectives

On completion of this course, students should be able to display a broad understanding of what culture is and how it is manifested in society. The students will be able to display an understanding of the different ethical beliefs that are evident both within societies and across different societies. Students will be able to define ethics and culture and understand their roles in a commercial context.

Syllabus

Definition of Culture; definition of Ethics; Cultural factors in family businesses; Inter-cultural differences; Cultural influences in different economies; A conceptual framework of ethics, law, and culture; Consequentialist approach to ethics; Judgmental approach to ethics; Motivist approach to ethics; Ethics and business Management.

TECHCOMM 3005

Technology Commercialisation

3 units - semester 2

Aims

This course has been designed for those who need a basic understanding of the concepts of successful commercialisation of innovation.

Objectives

Students will have a sound understanding of the processes, benefits and outcomes of commercializing innovations in a commercial environment. Students will be able to assess the intellectual property issues and other risks and prepare a business case.

Syllabus

The Commercialisation Process; Linking with Industry; Marketing & Business Communication of the commercialisation process; Economic factors; Risk factors; Intellectual Property; Technology transfer.

TECHCOMM 3005NA

Technology Commercialisation

3 units - quadmester 4

Aims

This course has been designed for those who need a basic understanding of the concepts of successful commercialisation of innovation.

Objectives

Students will have a sound understanding of the processes, benefits and outcomes of commercializing innovations in a commercial environment. Students will be able to assess the intellectual property issues and other risks and prepare a business case.

Syllabus

The Commercialisation Process; Linking with Industry; Marketing & Business Communication of the commercialisation process; Economic factors; Risk factors; Intellectual Property; Technology transfer.

TECHCOMM 3006

Energy Management, Economics & Policy

3 units - semester 1

Up to 4 hours per week

Available for Non-Award Study

Assumed Knowledge: MECH ENG 1105

Assessment: Group assignment; individual assignment; exam.

National and world economic perspectives on energy; The economics of energy; Problems and current status of energy; International treaties

Australian energy sources; Emerging energy management systems; The national electricity grid; Problems myths and truths about energy supply politics and policy

TECHCOMM 4001

Creating Digital Media Ventures

3 units - summer semester

Intensive

Available for Non-Award Study

Assessment: Report, online short answers, exam

This course is designed for those who are, or those who want to be, actively starting a new venture involving digital media technologies. The course is not a technology course but is an entrepreneurial strategy course that deals extensively with the particular dynamics of new industries such as those characterised by digital media. The focus will be on developing business models that maintain revenue streams, build value, engage with continuous research and development and aim to grow by accessing global markets. Students will examine and develop the skills necessary for managing flexible teams that embrace and endorse collaboration and fast decision making in rapidly changing technology environments.

Statistics

STATS 1000

Statistical Practice I

3 units - semester 1 or semester 2

Up to 5 hours per week

Restriction: may not be presented towards the Bachelor of Mathematical and Computer Science degree.

Available for Non-Award Study

Assumed Knowledge: SACE stage 2 Mathematical Methods or equivalent

Incompatible: STATS 1004, STATS 1005, ECON 1008, STATS 2004, APP MTH 2009, APP MTH 2010 or STATS 1504

Assessment: ongoing assessment 30%, exam 70%

Statistical ideas and methods are essential tools in virtually all areas that rely on data to make decisions and reach conclusions. This includes diverse fields such as medicine, science, technology, government, commerce and manufacturing. In broad terms, statistics is about getting information from data. This includes both the important question of how to obtain suitable data for a given purpose and also how best to extract the information, often in the presence of random variability. This course provides an introduction to the contemporary application of statistics to a wide range of real world situations. It has a strong practical focus using the statistical package SPSS to analyse real data.

Topics covered are: organisation, description and presentation of data; design of experiments and surveys; random variables, probability distributions, the binomial distribution and the normal distribution; statistical inference, tests of significance, confidence intervals; inference for means and proportions, one-sample tests, two independent samples, paired data, t-tests, contingency tables; analysis of variance; linear regression, least squares estimation, residuals and transformations, inference for regression coefficients, prediction.

STATS 1004

Statistical Practice I (Life Sciences)

3 units - semester 1 or semester 2

Up to 5 hours per week

Restriction: may not be presented towards the Bachelor of Mathematical and Computer Science degree.

Available for Non-Award Study

Assumed Knowledge: SACE stage 2 Mathematical Methods or equivalent

Incompatible: STATS 1000, STATS 1005, ECON 1008, STATS 2004, APP MTH 2009, APP MTH 2010 or STATS 1504

Assessment: ongoing assessment 30%, exam 70%

Statistical ideas and methods are essential tools in virtually all areas that rely on data to make decisions and reach conclusions. This includes diverse fields such as science, technology, government, commerce, manufacturing and the life sciences. In broad terms, statistics is about getting information from data. This includes both the important question of how to obtain suitable data for a given purpose and also how best to extract the information, often in the presence of random variability. This course provides an introduction to the contemporary application of statistics to a range of real world situations. It has a strong practical focus using the statistical package SPSS to analyse real data relevant to the life sciences.

Topics covered are: organisation, description and presentation of data in the life sciences; design of experiments and surveys; random variables, probability distributions, the binomial distribution and the normal distribution; statistical inference, tests of significance, confidence intervals; inference for means and proportions, one-sample tests, two independent samples, paired data, t-tests, contingency tables; analysis of variance; linear regression, least squares estimation, residuals and transformations, inference for regression coefficients, prediction.

STATS 1005

Statistical Analysis and Modelling 1

3 units - semester 2

Up to 5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1011 or MATHS 1013

Incompatible: STATS 1000, STATS 1004, STATS 1504, ECON 1008

Assessment: assessment 30%, exam 70%

This is a first course in Statistics for mathematically inclined students. It will address the key principles underlying commonly used statistical methods such as confidence intervals, hypothesis tests, inference for means and proportions, and linear regression. It will develop a deeper mathematical understanding of these ideas, many of which will be familiar from studies in secondary school. The application of basic and more advanced statistical methods will be illustrated on a range of problems from areas such as medicine, science, technology, government, commerce and manufacturing. The use of the statistical package SPSS will be developed through a sequence of computer practicals.

Topics covered will include: basic probability and random variables, fundamental distributions, inference for means and proportions, comparison of independent and paired samples, simple linear regression, diagnostics and model checking, multiple linear regression, simple factorial models, models with factors and continuous predictors.

STATS 1504

Statistical Practice I (Life Sciences) (Pre-Vet)

3 units - semester 1 or semester 2

Up to 5 hours per week

Restriction: Available to BSc(AnimalScPre-Vet) students only

Assumed Knowledge: SACE stage 2 Mathematical Methods or equivalent

Incompatible: STATS 1000, STATS 1005, ECON 1008, STATS 2004, APP MTH 2009, APP MTH 2010 or STATS 1004

Assessment: ongoing assessment 30%, exam 70%

Statistical ideas and methods are essential tools in virtually all areas that rely on data to make decisions and reach conclusions. This includes diverse fields such as science, technology, government, commerce, manufacturing and the life sciences. In broad terms, statistics is about getting information from data. This includes both the important question of how to obtain suitable data for a given purpose and also how best to extract the information, often in the presence of random variability. This course provides an introduction to the contemporary application of statistics to a range of real world situations. It has a strong practical focus using the statistical package SPSS to analyse real data relevant to the life sciences.

Topics covered are: organisation, description and presentation of data in the life sciences; design of experiments and surveys; random variables, probability distributions, the binomial distribution and the normal distribution; statistical inference, tests of significance, confidence intervals; inference for means and proportions, one-sample tests, two independent samples, paired data, t-tests, contingency tables; analysis of variance; linear regression, least squares estimation, residuals and transformations, inference for regression coefficients, prediction.

STATS 2107

Statistical Modelling and Inference

3 units - semester 2

Up to 3.5 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105

Assumed Knowledge: STATS 1000 or STATS 1004 or STATS 1005, MATHS 2103

Incompatible: STATS 2011

Assessment: ongoing assessment 30%, exam 70%

Statistical methods are important to all areas that rely on data including science, technology, government and commerce. To deal with the complex problems that arise in practice requires a sound understanding of fundamental statistical principles together with a range of suitable modelling techniques. Computing using a high level statistical package is also an essential element of modern statistical practice. This course provides an introduction to the principles of statistical inference and the development of linear statistical models with the statistical package R.

Topics covered are: Point estimates, unbiasedness, mean-squared error, confidence intervals, tests of hypotheses, power calculations, derivation of one and two-sample procedures; simple linear regression, regression diagnostics, prediction; linear models, ANOVA, multiple regression, factorial experiments, analysis of covariance models, model building; likelihood based methods for estimation and testing, goodness of fit tests; sample surveys, population means, totals and proportions, simple random samples, stratified random samples.

STATS 3001

Statistical Modelling III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): Pass in MATHS 1012 or MATHS 2105; Pass in one of STATS 1000, STATS 1004, STATS 2004, APP MTH 2009, APP MTH 2010, STATS 1504 or MATHS 2201

Assumed Knowledge: STATS 2011 or STATS 2107

Assessment: ongoing assessment 30%, exam 70%

One of the key requirements of an applied statistician is the ability to formulate appropriate statistical models and then apply them to data in order to answer the questions of interest. Most often, such models can be seen as relating a response variable to one or more explanatory variables. For example, in a medical experiment we may seek to evaluate a new treatment by relating patient outcome to treatment received while allowing for background variables such as age, sex and disease severity. In this course, a rigorous discussion of the linear model is given and various extensions are developed. There is a strong practical emphasis and the statistical package R is used extensively.

Topics covered are: the linear model, least squares estimation, generalised least squares estimation, properties of estimators, the Gauss-Markov theorem; geometry of least squares, subspace formulation of linear models, orthogonal projections; regression models, factorial experiments, analysis of covariance and model formulae; regression diagnostics, residuals, influence diagnostics, transformations, Box-Cox models, model selection and model building strategies; models with complex error structure, split-plot experiments; logistic regression models.

STATS 3003

Sampling Theory and Practice III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): Pass in MATHS 1012 or MATHS 2105; Pass in one of STATS 1000, STATS 1004, STATS 2004, APP MTH 2009, APP MTH 2010, STATS 1504 or MATHS 2201

Assumed Knowledge: STATS 2011 or STATS 2107

Assessment: ongoing assessment 30%, exam 70%

Sample surveys are an important source of statistical data. A great many published statistics on demographic, economic, political and health related characteristics are based on survey data. Simple random sampling is a well known method of sampling but, for reasons of efficiency and practical constraints, methods such as stratified sampling and cluster sampling are typically used by statistical authorities such as the Australian Bureau of Statistics and by market research organisations. This course is concerned with the design of sample surveys and the statistical analysis of data collected from such surveys.

Topics covered are: experiments and surveys, steps in planning a survey; randomisation approach to sampling and estimation, sampling distribution of estimator, expected values, variances, generalisation of probability sampling; prediction approach, inadequacies of approach, decomposition of population total, concomitant variables; regression through the origin, estimation by least squares, ratio estimation, variance formulae; balance and robustness; best fit sample; stratified sampling, estimation, allocation, construction of strata, stratification on size variables, post-stratification; two-stage sampling, estimation, allocation, cluster sampling.

STATS 3005

Time Series III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105, & one of STATS 1000, STATS 1004, STATS 1005, STATS 2004, APP MTH 2009, APP MTH 2010, STATS 1504 or MATHS 2201

Assumed Knowledge: STATS 2011 or STATS 2107

Assessment: ongoing assessment 30%, exam 70%

Time series consist of values of a variable recorded over a long period of time. Such data arise in just about every area of science and the humanities, including econometrics and finance, engineering, medicine, genetics, sociology, environmental science. What makes time series data special is the presence of dependence between observations in a series, and the fact that usually only one observation is made at any given point in time. This means that standard statistical methods are not appropriate, and special methods for statistical analysis are needed. This course provides an introduction to time series analysis using current methodology and software.

Topics covered are: descriptive methods, plots, smoothing, differencing, the autocorrelation function, the correlogram and the variogram; the periodogram, estimation and elimination of trend and seasonal components; stationary processes, modelling and forecasting with autoregressive moving average (ARMA) models; spectral analysis, the fast Fourier transform, periodogram averages and other smooth estimates of the spectrum, time-invariant linear filters; non-stationary and seasonal time series models. ARIMA processes, identification, estimation and diagnostic checking, forecasting, including extrapolation of polynomial trends, exponential smoothing, and the Box-Jenkins approach.

STATS 3006

Mathematical Statistics III

3 units - semester 1

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105, & one of STATS 1000, STATS 1004, STATS 1005, STATS 2004, APP MTH 2009, APP MTH 2010, MATHS 1504 or MATHS 2201

Assumed Knowledge: STATS 2011 or STATS 2107

Assessment: ongoing assessment 30%, exam 70%

Statistical methods used in practice are based on a foundation of statistical theory. One branch of this theory uses the tools of probability to establish important distributional results that are used throughout statistics. Another major branch of statistical theory is statistical inference. It deals with issues such as how do we define a "good" estimator or hypothesis test, how do we recognise one and how do we construct one? This course is concerned with the fundamental theory of random variables and statistical inference.

Topics covered are: calculus of distributions, moments, moment generating functions; multivariate distributions, marginal and conditional distributions, conditional expectation and variance operators, change of variable, multivariate normal distribution, exact distributions arising in statistics; weak convergence, convergence in distribution, weak law of large numbers, central limit theorem; statistical inference, likelihood, score and information; estimation, minimum variance unbiased estimation, the Cramer-Rao lower bound, exponential families, sufficient statistics, the Rao-Blackwell theorem, efficiency, consistency, maximum likelihood estimators, large sample properties; tests of hypotheses, most powerful tests, the Neyman-Pearson lemma, likelihood ratio, score and Wald tests, large sample properties.

STATS 3008

Biostatistics III

3 units - semester 2

Up to 3 hours per week

Available for Non-Award Study

Pre-Requisite(s): MATHS 1012 or MATHS 2105, & one of STATS 1000, STATS 1004, STATS 1005, STATS 2004, APP MTH 2009, APP MTH 2010, STATS 1504 or MATHS 2201

Assumed Knowledge: STATS 2011 or STATS 2107

Assessment: ongoing assessment 30%, exam 70%

Biostatistics is the branch of statistics developed for applications within the biomedical, pharmaceutical and health sciences. These methods are fundamental to contemporary medical research. They play a key role in evaluating treatments for diseases such as cancer and heart disease, in predicting the spread and incidence of epidemics and in evaluating the risk associated with factors such as obesity or exposure to electromagnetic radiation. This course provides an introduction to the design and analysis of clinical trials and epidemiological studies, and methods for the analysis of biostatistical data.

Topics covered are: the role of randomisation and ethical considerations, Phase I to Phase IV trials, the Data and Safety Monitoring Board; methods of randomisation, unrestricted and restricted randomisation, random permuted blocks, biased coin designs, stratification, minimisation; trial size, fixed, sequential and group sequential trials, factorial trials, crossover trials and equivalence trials; epidemiology, cohort, case-control and related epidemiological studies, models for disease association, relative risk, odds ratio, attributable risk; diagnostic tests and screening, meta-analysis, survival analysis.

STATS 4000A/B

Honours Statistics Part 1 & 2

24 units - full year

Restriction: Available only to students admitted to the relevant Honours program

Pre-Requisite(s): At least 12 units of Level III Mathematical Sciences courses at credit standard or above, of which at least 9 units must be from the Discipline - different backgrounds may be accepted at the discretion of the Head of School.

Assessment: Exams for each course at end of semester in which it is offered, project, seminar

Students are required to obtain the approval of the Head of Mathematical Sciences before enrolling in the program, and should preferably consult with the Head before enrolling for Level III. Candidates may apply to the Head for permission, under certain circumstances, to take Honours over two years.

Students select from lecture courses offered by the School of Mathematical Sciences and other Schools as may be agreed to by Head of Mathematical Sciences. Students may be allowed to take appropriate Level III Mathematical Sciences courses not already taken.

Students are assigned a supervisor to advise on and approve their lecture program and give guidance in writing a project on a Statistics topic. Possible topics should be discussed with staff during the preceding year.

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