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## ENGINEERING SUBJECT DESCRIPTIONS

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### CIVL196 Engineering Computing I 6cp

Autumn Wollongong On Campus

Contact Hours: 52

**Assessment:** Assignments: objectives i – iv. Mid-Session examination: objectives i, ii and iii. One 2 hour final examination: objective iv.

**Subject Description:** Operating Systems - understand the essentials of WINDOWS Operating System; Spreadsheets - solving engineering problems using EXCEL, preparing reports, customising tables and graphs. Preparing technical reports using MS Word. Introduction to computer programming using MATLAB, scalar and vector variables, assignment statements, program loops, program branches, sub-programs, input and output files, graphics.

### CIVL245 Construction Materials 6cp

Spring Wollongong On Campus

**Assessment:** One 2 hour final examination: objectives i to iii. Laboratory work: objective iv. Assignments: objectives i to iii.

**Subject Description:** The subject is designed to introduce the properties and use of the more common materials in modern construction practice. Topics will include: Concrete - Properties of concrete; structure and composition; cements; mix design; durability; high performance concrete; concrete manufacture Steel - Properties of steel with particular reference to brittle fracture, fatigue, corrosion and fire damage Alternative materials - timber; masonry; polymers; aluminium; composites.

### CIVL272 Surveying 6cp

Spring Wollongong On Campus

**Assessment:** Final examination: objectives i, iii, iv. Mid-session examination: objectives i, iii, iv. Tutorial: objectives i, iii, iv. Fieldwork: objectives i to iv.

**Subject Description:** Basic concepts - Australian map grid, Integrated survey grid, Australian height datum, control surveys, locating position, errors in measurement, units in surveying and significant figures. Measuring distances, reduced levels and angles. Determining position - traversing, global positioning systems and plane rectangular coordinates. Earthworks and volumes. Setting out - basic procedures, setting out curves, trenches, sewers, buildings and slope stakes for road grade. Introduction to underground surveying. Computer assisted data reduction. In addition to theoretical instruction, fieldwork assignments will be undertaken in electromagnetic distance measurement, traversing, levelling, curve ranging, staking a \ slope, and, for mining students, practical surveying in an underground environment.

### CIVL311 Structural Design 1 6cp

Autumn Wollongong On Campus

**Assessment:** Design projects/tutorial assignments: objectives i to iv. 1 hour mid-session examination: objectives i to iv. 2 hour final examination: objectives 1 to iv.

**Subject Description:** Introduction to structural design, dead and live loads. Review of limit states design. Design of reinforced concrete structural elements according to AS 3600.

Strength and serviceability of reinforced concrete beams and one way slabs. Design of reinforced concrete columns for strength and stability.

Design of steel beams and girders to AS 4100. Design of tension and compression members for trusses. Introduction to local and lateral buckling. Design of bolted and welded steel connections.

### CIVL314 Structural Design 2 6cp

Spring Wollongong On Campus

**Pre-requisite:** CIVL311 Structural Design 1

**Assessment:** Design, Projects/Tutorial, Assignments: objectives i to iii. 2 hour Final Examination: objectives i to iii.

**Subject Description:** This course will consider an introduction to wind and seismic loads, reinforced concrete structures including the serviceability and strength design of reinforced concrete two way slab and flat plates for multistorey buildings together with reinforced concrete footings and retaining structures. An introduction to the design of prestressed concrete beams for serviceability and strength for both buildings and bridges. Case studies of multistorey building frames.

### CIVL322 Hydraulics and Hydrology 6cp

Spring Wollongong On Campus

Contact Hours: 56

**Co-requisites:** ENGG252 - Engineering Fluid Mechanics

**Assessment:** 2 hour Final Examination: objectives i to iii. Mid-Session Quiz: objectives i and ii. Laboratory reports and projects: objectives iii and iv.

**Subject Description:** Open Channel Hydraulics - uniform flow; gradually varied flow; changes in channel cross section; hydraulic structures; unsteady flow Flood Hydrology - data collection and analysis; flood frequency; rainfall intensity-frequency-duration relationships; unit hydrograph; design flood estimation; flood routing in rivers and storage reservoirs Pipeline and pumping systems - pipe networks; water distribution systems; pump characteristics; pressure surges.

### CIVL352 Structures 1 6cp

Autumn Wollongong On Campus

**Pre-requisite:** ENGG251 - Mechanics of Solids

**Assessment:** 2 hour final examination: objectives i to iii. 1 hour mid-session examination: objectives i to iii. Other assignments may be taken into consideration: objectives i to iii.

**Subject Description:** Statically determinate and indeterminate trusses and frames. Flexibility and stiffness methods. Moment distribution. Unsymmetrical bending; shear centre. Elastic stability. Influence lines.

### CIVL361 Geomechanics 1 6cp

Autumn Wollongong On Campus

**Assessment:** 2 hour final examination: objectives i to iv; Class tests/assignments: objectives i to v.

**Subject Description:** Soils and rocks - differences and similarities; cohesionless and cohesive soils; behaviour of intact and jointed rock masses; weight-volume relationships;

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particle size distribution; index properties of soils; soil classification; soil compaction and compressibility; mechanical properties of rock. Some topics will be presented in a laboratory environment. Pore water pressures and effective stress concept; permeability of soil and hydraulic properties of rock masses; groundwater flow; seepage theory; flow nets. Shear strength of soils and rock masses, total and effective stress parameters, Mohr-Coulomb criterion; Hoek and Brown failure; sliding on planes of weakness. Application of elastic theory for calculating stresses and displacements within soil or rock masses. Stability analysis of soil and rock slopes; stabilisation methods.

### **CIVL392 Engineering Computing 2 6cp**

**Autumn** Wollongong On Campus

**Contact Hours:** 56

**Pre-requisites:** CIVL196 and MATH283

**Assessment:** Mid-Session examination: objectives i to iii. 2 hour final examination: objectives i to iv. Reports and assignments: objectives i to iv.

**Subject Description:** Numerical computation. Taylor series, roots of equations, numerical differentiation, difference tables, linear systems, numerical integration, differential equations. Use of applications software. Numeric Computation and Visualisation - MATLAB interactive, graphically based system for solving mathematical and engineering problems.

### **CIVL394 Construction 6cp**

**Spring** Wollongong On Campus

**Assessment:** Final examination: objectives i to v. Class test: objectives i to iii. Tutorials or project reports: objectives i to v.

**Subject Description:** The subject is designed to provide students with detailed knowledge of construction with regard to both surface and underground structures, including construction techniques, stability and maintenance aspects. The following subject material will be covered: Plant and equipment in Civil Engineering practice; Construction processes and quality control; Tunnelling in soft ground and rock; Cofferdams and caissons; Harbour works; Dewatering and grouting methods; Performance monitoring and observational design; underpinning and restoration techniques; formwork and scaffolding. The lectures and tutorials will be complemented with practical project work and a field trip.

### **CIVL415 Structural Design 3 6cp**

**Autumn** Wollongong On Campus

**Pre-requisites:** CIVL311 Structural Design 1 and CIVL314 Structural Design 2.

**Assessment:** Major design projects: objectives i to iv.

**Subject Description:** This subject includes the design of some large steel, concrete, timber and mixed structures. Gravity and lateral load resisting systems for steel, concrete, timber and mixed construction frames for wind and earthquake loads. Advanced design considerations in steel and concrete structures. Implications of fire and corrosion for steel structures, and creep and shrinkage effects in concrete structures. Advanced reinforced concrete design including shear walls, deep beams and pile caps. Integrated topics may include the design of transmission towers, large industrial buildings, multistorey buildings, carparks or other structures which enable integration of the concepts of structural design and construction.

### **CIVL444 Civil Engineering Design 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 52

**Pre-requisites:** CIVL361 Geomechanics 1, CIVL311 Structural Design 1, CIVL322 Hydraulics and Hydrology.

**Assessment:** No formal examination will be held. Submitted design work and assignments will be assessed covering all objectives. Site visits may be arranged.

**Subject Description:** Major Civil Engineering design, which will cover an integrated project incorporating geotechnical, hydraulic, structural and transport engineering.

### **CIVL454 Structures 2 6cp**

**Spring** Wollongong On Campus

**Pre-requisite:** CIVL352 Structures 1

**Assessment:** 2 hour final examination: objectives i to iii. 1 hour mid-session examination: objectives i to iii. Laboratory reports: objective iv. Other assignments may be taken into account: objectives i to iii.

**Subject Description:** Ultimate load analysis of beams, plates, slabs and frames in steel and concrete. Composite beams and columns. Vibrations due to earthquake, wind, and water. Dynamics of single degree of freedom systems.

### **CIVL457 Structures 3 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** CIVL352 - Structures 1

**Assessment:** 2 hour final examination: objectives i and ii. 1 hour mid-session examination: objective i. Designated tutorial exercises will be assessed: objectives i and ii.

**Subject Description:** Elementary structural concepts using matrix algebra. Structural assemblages. Finite element analysis for one, two and three dimensional problems. Computer applications in statics, stability and dynamics.

### **CIVL462 Geomechanics 2 6cp**

**Autumn** Wollongong On Campus

**Pre-requisite:** CIVL361 - Geomechanics 1

**Assessment:** 2 hour final examination: objectives i to iv. Class tests/assignments: objectives i to iv.

**Subject Description:** One-dimensional theory of consolidation, primary and secondary consolidation; normally consolidated and over consolidated soils; settlement analysis. Relationship between principal stresses at failure, importance of drainage conditions in soils, fully undrained conditions for saturated soils; drained and undrained shear strength of cohesive soils, behaviour of partially saturated soils. Overburden and lateral stresses, active and passive pressures, Rankine's earth pressure theory, Coulomb's wedge theory, geotechnical aspects of retaining walls, drainage of backfill. Bearing capacity of foundations; shallow footings and rafts, pile foundations, contact stress and subgrade reaction; use of elastic theory for stress and settlement calculation in soils and rocks. Unconfined seepage through earth structure, seepage control in dams, design of filters.

- CIVL463 Geomechanics 3** **6cp**  
**Spring** Wollongong On Campus  
**Pre-requisite:** CIVL462 - Geomechanics 2  
**Assessment:** 2 hour final examination: objectives i to iii. Class tests/assignments: objectives i to iii.  
**Subject Description:** Models of soil behaviour, stress paths in soil mechanics, total and effective stress paths, Stress strain behaviour of different types of soil under drained and undrained conditions; strain-softening; peak, softened and residual shear strength of cohesive soils; pore pressure co-efficients A and B and their use in practical problems. Soil behaviour under earthquake conditions, the phenomenon of liquefaction. Comparison of laboratory and field testing for geotechnical investigation; uncertainties in geomechanics, Analysis of cantilever and anchored sheet piles, analysis of strutted excavations.
- CIVL487 Traffic Engineering** **6cp**  
**Contact Hours:** Not on offer in 2004  
**Assessment:** 2 hour final examination: objectives i to iv. Other short examinations and assignments may be taken into consideration: objectives i to iv.  
**Subject Description:** The subject is designed to provide students with detailed knowledge of traffic and transport engineering. The subject will cover traffic engineering systems, traffic flow theory, intersection capacity, traffic control devices, accident studies, traffic survey methods, traffic management, transport network models, and use of traffic simulation programs. All these roads and traffic designs are to comply with the requirements of the current Australian Standards and codes of practice. The subject will include a number of tutorials, computer applications and field work.
- CIVL489 Roads Engineering** **6cp**  
**Autumn** Wollongong On Campus  
**Pre-requisites:** ENGG251 Mechanics of Solids and CIVL361.  
**Assessment:** 2 hour final examination: objectives i to v. Other short examinations and assignments may be taken into consideration: objectives i to v.  
**Subject Description:** The subject is designed to provide students with detailed knowledge of roads engineering: the design of roads both geometrically and structurally, construction and rehabilitation of roads. The subject will cover the following topics: route selection, road location, environmental factors, land information systems, geometric design of rural roads, pavement and subgrade materials, vehicular loading, analysis of road pavements, pavement design, road drainage, recycling pavements, cost analysis, planning and road construction and traffic engineering. All these roads designs are to comply with the requirements of the current Australian Standards and codes of practice. The subject may include a number of tutorials, computer applications and field work.
- CIVL491 Engineering Computing 3** **6cp**  
**Spring** Wollongong On Campus  
**Pre-requisite:** CIVL392  
**Assessment:** Reports and assignments will be assessed: objectives i and ii. No formal examination.

**Subject Description:** Use of engineering applications software, including structural and geotechnical mechanics, using finite element programs for stress, stability, and dynamic analysis. Discrete simulation. Depending on the availability of software other applications may be utilised. Problems will be selected from various areas in engineering.

- CIVL495 Public Health Engineering** **6cp**  
**Spring** Wollongong On Campus  
**Pre-requisite:** ENGG252 - Fluid Mechanics  
**Assessment:** Two 1.5 hour class tests and two design and laboratory reports.  
**Subject Description:** The subject is designed to introduce public and environmental engineering concepts to civil engineers. The public health issues relating to natural resources, ecological concepts, water supply and sanitation problems, water and wastewater characteristics, water quality standards and guidelines, engineering management of water quality processes in rivers and lakes, stormwater and mine water pollution and control, design of water supply and treatment processes, design of wastewater collection, treatment, reuse and disposal systems, industrial water treatment and reuse will be discussed. The lecture components will be complemented with tutorials, laboratory classes and field trips.

- ENGG152 Engineering Mechanics** **6cp**  
**Spring** Wollongong On Campus  
**Assessment:** 2 hour final examination: objectives i to iv. Other short examinations: objectives i to iv. Laboratory reports: objectives i and v.  
**Subject Description:** Two dimensional statics of particles and rigid bodies. Forces in frames. Kinematics of particles in rectilinear and plane motion. Kinetics of particles: equations of motion; work and energy; impulse and momentum.

- ENGG154 Engineering Design and Innovation** **6cp**  
**Autumn** Wollongong On Campus  
**Contact Hours:** 5-6 hours per week  
**Assessment:** Progressive Assessment through quizzes: objectives i and ii. Assignments: objective i. Design reports: objective iii. Presentations: objective iii.  
**Subject Description:** (a) Engineering Drawing: Introduction and standards information; geometrical constructions; freehand sketching; the production of a mechanical drawing; orthographic projection; selection and layout of views; sectional views of orthographic projections; auxiliary views of orthographic projections; general arrangements and assembly drawings.  
 (b) Computer-Aided Drafting: Introduction to computer aided drafting; use of entity draw and selected utility commands and services; dimensioning, display controls; coordinate systems; editing and inquiry commands; entity properties (layers) and use of blocks. (c) The phases of design; team building; design and manufacturing processes; design models; design economics; decision processes; creative design; case studies. The three sections of this subject will be presented as an integrated whole. This will be achieved through a number of creative design projects and case studies.

**ENGG171 Scholars Research Project 1 6cp**

**Annual** Wollongong On Campus

**Contact Hours:** No formal contact hours

**Restrictions:** Students must be enrolled in the Engineering Scholars Program.

**Assessment:** Research proposal, seminar presentation, progress report and final report.

**Subject Description:** The subject introduces students to specific areas of research in the field of Engineering. Topics will be negotiated based on the current activities of various research units linked to the Faculty of Engineering and the interests of the student. Students will join a particular project and undertake certain tasks under the supervision of a designated staff member. Students are required to undertake literature reviews, collect and analyse data and report on their findings to the research team. Hands on experience in an engineering laboratory is a feature.

**ENGG251 Mechanics of Solids 6cp**

**Autumn** Wollongong On Campus

**Contact Hours:** 5 hours per week

**Pre-requisite:** ENGG152 Engineering Mechanics

**Assessment:** Tutorial and laboratory assignments: objectives i to iv. 1 hour mid-session quiz: objectives i and ii. 3 hour final examination: objectives i and ii.

**Subject Description:** Stress on a section, concept of stress-strain relationship and Hooke's Law. Torsion of shafts and hollow sections. Problems in bending and stress of beams. Analysis of plane stress and plane strain, combined stresses. Introductory yield criteria for metals, and anelastic behaviour of non metals. Deflection of beams and frames. Statically indeterminate beams, and simple column buckling. Thermal stresses and energy methods. Experimental techniques. Prerequisite minimum preparation is Engineering Mechanics, Engineering Mathematics and Engineering Materials.

**ENGG252 Engineering Fluid Mechanics 6cp**

**Autumn** Wollongong On Campus

**Co-requisites:** MATH142 or MATH188.

**Assessment:** Final examination: objectives i to v. Mid-session quizzes: objectives i and iv. Tutorial assessments: objectives i to iv. Laboratory work on hydrostatics, momentum of fluid, venturi meter, wave flow and pipe flows.

**Subject Description:** This subject is designed to introduce elementary fluid mechanics concepts for civil, environmental, mechanical and mining engineers.

The topics include fluid properties, hydrostatics, manometry, Bernoulli's, mass, energy and momentum equations and their applications, dimensional analysis, fluid flow in pipes, pipe friction losses and fluid flow measurements. The lecture components will be complemented with tutorials and laboratory classes. This subject intends to provide a working knowledge to solve simple fluid flow problems in the various branches of engineering. Students are assumed to have knowledge of 1st year engineering mathematics.

**ENGG255 Professional Option 2 6cp**

**Annual** Wollongong On Campus

**Autumn / Spring** Wollongong On Campus

**Contact Hours:** No formal contact hours

**Restrictions:** Only part-time students in full-time employment allowed to enrol.

**Assessment:** A work plan, a 4000 word report and a formal seminar presentation. All submitted material must be certified by a professional supervising engineer.

**Subject Description:** This subject is for students currently in approved full-time employment and enrolled in a part-time study program. This subject will normally be taken in Stages 3, 4 or 5 of the BE Program. Students must seek approval to enrol in this subject from the Director of Studies. Approval will be granted to students who can demonstrate that their employment provides appropriate experience and training as part of their degree program. Approval will not be granted for work that involves essentially trivial/routine tasks or that is not directly related to the discipline of engineering relevant to the student's program.

**ENGG271 Scholars Research Project 2 6cp**

**Annual** Wollongong On Campus

**Contact Hours:** No formal contact hours

**Restrictions:** Students must be enrolled in the Engineering Scholars Program.

**Assessment:** Research proposal, seminar presentation, progress report and final report.

**Subject Description:** The subject introduces students to specific areas of research in the field of Engineering.

Topics will be negotiated based on the current activities of various research units linked to the Faculty of Engineering and the interests of the student. Students will join a particular project and undertake certain tasks under the supervision of a designated staff member. Students are required to undertake literature reviews, collect and analyse data and report on their findings to the research team. Experience in engineering design, experimentation and data analysis will be a feature.

**ENGG291 Engineering Fundamentals 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 5 hours per week

**Assessment:** Examinations (60%). Laboratory work and assignments (40%).

**Subject Description:** This subject is designed to provide students from disciplines such as Electrical, Telecommunications and Computer Engineering with an introduction to some other Engineering disciplines which have an important role in the design and application of electrical and computer technologies. Three main areas are covered. Heat Transfer- Conduction, convection and radiation heat transfer as applicable to the field of electrical engineering. Engineering Mechanics- Forces, moments and equilibrium states; stress in beams, cylinders and shafts; simple deflection analysis. Materials Engineering- Overview, of engineering materials; bonding and crystal structure in electrical and electronic materials; origin of electrical and electronic properties; structure and properties of electrical and electronic materials; selection of materials for application in electrical engineering.

**ENGG355 Professional Option 3** **6cp**  
**Annual** Wollongong On Campus  
**Contact Hours:** No formal contact hours

**Restrictions:** Only part-time students in full time employment are allowed to enrol.

**Assessment:** A work plan, a 4000 word report and a formal seminar presentation. All submitted material must be certified by a professional supervising engineer.

**Subject Description:** This subject is for students currently in approved full-time employment and enrolled in a part-time study program. This subject will normally be taken in Stages 3, 4 or 5 of the BE Program. Students must seek approval to enrol in this subject from their Director of Studies. Approval will be granted to students who can demonstrate that their employment provides appropriate experience and training as part of their degree program. Approval will not be granted for work that involves essentially trivial/routine tasks or that is not directly related to the discipline of engineering relevant to the student's program.

**ENGG361 Engineering Management** **6cp**  
**Spring** Wollongong On Campus

**Assessment:** Case study report; examination, tutorial papers, and tutorial presentation.

**Subject Description:** This subject identifies and examines the economic, financial and statutory basis for decisions required in the evaluation of proposed engineering projects, and in the financial management of engineering projects and operations.

It provides a brief introduction to the foundations of modern quality management and to statistical quality control methods relevant to engineering operations. It also provides an introduction to the law of contracts and to the evaluation and management of engineering contracts.

**ENGG371 Scholars Research Project 3** **6cp**  
**Annual** Wollongong On Campus

**Contact Hours:** No formal contact hours

**Restrictions:** Students must be enrolled in the Engineering Scholars Program.

**Assessment:** Research proposal, seminar presentation, progress report and final report.

**Subject Description:** The subject introduces students to specific areas of research in the field of Engineering. Topics will be negotiated based on the current activities of various research units linked to the Faculty of Engineering and the interests of the student. Students will join a particular project and undertake certain tasks under the supervision of a designated staff member. Students are required to undertake literature reviews, collect and analyse data and report on their findings to the research team. The research will include experience in an engineering laboratory and/or computer work.

**ENGG434 Introduction to Materials** **6cp**  
**Welding and Joining**

**Spring** Wollongong Flexible

**Exclusion:** MATE434 - Materials Welding and Joining

**Assessment:** Assignments (2). Quiz (computer based via WebCT). Exam.

**Subject Description:** The subject introduces the student to the selection and cost effective application of joining technology. OH&S and quality issues and recent welding innovations are covered.

**ENGG452 Thesis A** **12cp**

**Autumn** Wollongong On Campus

**Annual / Spring** Wollongong On Campus

**Spring 2005 /** Wollongong On Campus

**Autumn 2005**

**Pre-requisites:** Completion of 120cps

**Assessment:** Reports: objectives i to iii. Seminar: objective vi. Manuscript: objectives i to vi.

**Subject Description:** All students must complete a 12 credit point thesis (ENGG452) normally over a period of two sessions - though Scholars Program students may elect to take ENGG453. Students are expected to spend at least 336 hours on the 12 credit point thesis. The thesis is a core element of the degree in each engineering course. The knowledge and skills acquired in the design, experimentation, analysis, management and communications aspects of the course are brought together in an individual project undertaken by the student under the guidance of an academic supervisor. Individual disciplines will advise further requirements at the start of the thesis.

**ENGG453 Thesis B** **18cp**

**Annual** Wollongong On Campus

**Autumn / Spring** Wollongong On Campus

**Autumn** Wollongong On Campus

**Spring 2004 /** Wollongong On Campus

**Autumn 2005**

**Pre-requisite:** Completion of 120cps

**Assessment:** Reports: objectives i to iii. Seminar: objective vi. Manuscript: objectives i to vi.

**Subject Description:** As an alternative to ENGG452, subject ENGG453 (18 credit points) may be taken by students in the Engineering Scholars program, or by other high achieving students with the permission of the Sub Dean of Engineering. A student electing to take ENGG453 will undertake a longer period of work and complete a longer thesis. Students are expected to spend 504 hours on the 18 credit point thesis. The thesis is a core element of the degree in each engineering course. The knowledge and skills acquired in the design, experimentation, analysis, management and communications aspects of the course are brought together in an individual project undertaken by the student under the guidance of an academic supervisor. Individual disciplines will advise further requirements at the start of the thesis.

**ENGG454 Professional Experience** **Ocp**

**Autumn / Spring** Wollongong On Campus

**Assessment:** Written report (guidelines available from Engineering Enquiry Centre).

**Subject Description:** As a requirement for the award of the degree of Bachelor of Engineering, students are required to obtain at least 12 weeks approved professional experience in a relevant industry during the course and submit a report to the satisfaction of the Discipline Directors of Studies.

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It is preferable that candidates undertake this requirement during the summer recess, between the third and fourth years of the BE degree. Exemption from the requirement will be given to a student who has passed one or more of the Professional Option subjects. Refer to Discipline Directors' of Studies for details.

### ENGG455 Professional Option 4 6cp

**Annual** Wollongong On Campus

**Autumn / Spring** Wollongong On Campus

**Contact Hours:** No formal contact hours

**Restrictions:** Only part-time students in full-time employment allowed to enrol.

**Assessment:** A work plan, a 4000 word report and a formal seminar presentation. All submitted material must be certified by a professional supervising engineer.

**Subject Description:** This subject is for students currently in approved full-time employment and enrolled in a part-time study program. This subject will normally be taken in Stages 3, 4 or 5 of the BE Program. Students must seek approval to enrol in this subject from their Director of Studies. Approval will be granted to students who can demonstrate that their employment provides appropriate experience and training as part of their degree program. Approval will not be granted for work that involves essentially trivial/routine tasks or that is not directly related to the discipline of engineering relevant to the student's program.

### ENGG461 Project Management and Human Factors in Engineering 6cp

**Autumn** Wollongong On Campus

**Contact Hours:** 4 hours per week

**Assessment:** Assignments and examination - covering all objectives.

**Subject Description:** The particular topics addressed in this course, which every engineering student should know and be prepared to put into practice on entering his/her professional career, include: Project Management; Total Quality Management; Quantitative Management Techniques; Human Relations; Engineers' Ethics and Controversy; Engineers as Consultants/Experts; Accidents and Risk, Occupational Health and Safety; Maintenance Management; and Innovation Management.

### ENVE220 Water Quality Engineering 6cp

**Spring** Wollongong On Campus

**Pre-requisite:** ENGG252 - Engineering Fluid Mechanics

**Assessment:** 2 hour final examination: objectives i to v. 1hour mid-session quiz: objectives ii to iv. Laboratory reports: objectives i to v.

**Subject Description:** The subject is designed to introduce environmental engineering concepts at a fundamental level. The environmental problems and solutions relating to natural resources, ecological systems, water pollution, water quality processes in rivers and lakes, water supply and treatment processes, wastewater collection, treatment and disposal, water quality guidelines and other global environmental issues will be discussed. The lecture components will be complemented with tutorials and laboratory classes.

### ENVE221 Air and Noise Pollution 6cp

**Spring** Wollongong On Campus

**Assessment:** 2 hour Final Examination: objectives i and iv. Mid-session quizzes: objectives i and iii. Laboratory reports and projects: objectives i to iii.

**Subject Description:** Air Pollution - meteorology; atmospheric chemistry; air quality; sources of air pollution; effects of air pollution; dispersion modelling; control of air pollution. Noise Pollution - noise pollution legislation; sound power and intensity levels; noise from several sources; background noise effects; defining and measuring noise; weighting factors and equivalent noise levels; effect of noise on people; propagation of sound; noise control at source, during propagation and at receiver; design of noise barriers.

### ENVE311 Pollution Control and Cleaner Production 6cp

**Spring** Wollongong On Campus

**Pre-requisite:** ENVE220 - Water Quality Engineering

**Assessment:** Project report: objective iv. Tutorial/assignments: objective iii. 2 hour mid-session examination: objectives i and ii. 2 hour final examination: objectives i and ii.

**Subject Description:** This subject is divided into two sections. The first section deals with unit processes design. In this section all the physico-chemical processes commonly used for water pollution control will be discussed in detail. In the second section two topics viz, industrial waste management and cleaner production will be introduced. Industrial waste management includes source identification, characterisation, segregation, treatment and disposal. It also includes design of various unit operations/processes for liquid waste treatment. Application of advanced processes in an industry for waste treatment, reuse and recycling, and final disposal of wastes, plus overall waste auditing of an industry will be illustrated using a case study.

### ENVE320 Environmental Engineering Design 1 6cp

**Autumn** Wollongong On Campus

**Pre-requisite:** ENVE220 Water Quality Engineering

**Assessment:** 2 hour mid-session examination: objective ii. 2 hour end of session quiz: objectives iii to iv. Design reports: objective i to iv. Field trip assessment: objectives i and iv.

**Subject Description:** The subject is designed to introduce system design using unit processes encountered in environmental engineering. The subject will cover design concepts, detailed and advanced design of water supply and treatment systems, advanced solid-liquid separation processes, design of wastewater collection systems, design of advanced wastewater treatment plant design, ocean outfall systems, design of land based systems, network design. The subject also includes design of air pollution and control systems. The lecture components will be complemented with design classes and field trips.

**ENVE321 Solid and Hazardous Waste Management 6cp****Spring** Wollongong On Campus**Assessment:** Project report: objectives i to iv. Tutorial/assignments: objectives ii to iv. 2 hour mid-session examination: objectives i to v. 2 hour final examination: objectives i to v.**Subject Description:** This subject introduces fundamentals of solid and hazardous waste management. The content includes characterisation, collection, transportation, storage and final disposal of solid and hazardous waste. In the case of hazardous waste, additional topics of identification, classification, risk assessment, legislation and health hazards will be covered. Waste minimisation, reuse/recycle; stabilisation and volume reduction of hazardous waste are considered. Besides lectures and tutorial sessions, this subject includes field trips, laboratory classes and project work.**ENVE410 Site Remediation 6cp****Spring** Wollongong On Campus**Pre-requisite:** CHEM214 - Analytical and Environmental Chemistry**Assessment:** 2 hour final examination: objectives i to iii. Selection of mid-session quizzes: objectives i to iii. Lab reports: objective ii. Projects: objective iii.**Subject Description:** This subject introduces fundamentals of site remediation and will include topics such as site characterisation, containment, soil erosion and remediation technologies. Remediation technologies such as biodegradation, permeable barriers, composting, incineration and soil vapour extraction will be presented in detail. Containment topics will include cover systems, reactive barriers, vertical barriers and geosynthetics. Topics such as remediation of soft and compressible ground, and acid sulphate soils will also be presented.**ENVE420 Water Engineering 6cp****Autumn** Wollongong On Campus**Co-requisite:** CIVL322 - Hydraulics and Hydrology**Assessment:** 2 hour final examination: objectives i to iii. Mid-session quiz: objectives i to iii. Projects: objective iv.**Subject Description:** Coastal Engineering - wave forecasting; wave refraction; diffraction and breaking; wave forces on structures; beach erosion and beach protection. Water Resources - the hydrologic cycle; distribution of the world's water resources; surface water resources; groundwater resources; computer models of catchment water balances; storage reservoir yield analysis. River Engineering - fluvial hydraulics; morphology of natural channels; erosion and sediment transport; re-naturalising streams; remediation of polluted rivers. Urban Stormwater Management - stormwater quality and flooding problems in urban areas; flood reduction using detention basins; computer modelling of urban stormwater systems.**ENVE421 Environmental Engineering Design 2 6cp****Spring** Wollongong On Campus**Pre-requisites:** ENVE320, ENVE321 and CIVL322.**Assessment:** Five design reports: objective i.**Subject Description:** The ability to undertake a comprehensive integrated project design is the capstone of a student's engineering education. This subject will provide students with the opportunity to undertake the design of a major project.

Students will be provided with an overall concept plus specific requirements that must be met by the design. All aspects of environmental engineering will be involved, including impact assessment, legislation, and modelling. Topic areas that have not been presented in previous subjects, but are required for the successful completion of the project, will be covered during the lecture portion of the class. Lecture topics will include environmental impact assessment and legislation, and environmental modelling.

**ENVE422 Membrane Science and Technology 6cp****Autumn** Wollongong On Campus**Assessment:** Literature review and group presentation, system design group exercise and final exam.**Subject Description:** The subject intends to demonstrate to students how nature works (biological membranes) and how such principles (membrane processes) can be used for medical, water and wastewater, processing and other industries by engineering appropriate materials and systems. The subject hence leads from nature to material science and engineering, fundamental transport principles to applications and process design with immediate relevance to the water and wastewater treatment industry where membranes are becoming a predominant process choice worldwide. The subject aims to bring science and engineering together on a number of levels such as in terms of learning from nature, applying engineering solutions to medical applications and using scientific principles to obtain engineering solutions. Both engineering and science students will be exposed to the thinking in the other discipline.**MATE201 Structure and Properties of Materials 6cp****Autumn** Wollongong On Campus**Contact Hours:** 52**Pre-requisites:** ENGG153 - Engineering Materials or PHYS141 - Fundamentals of Physics A and PHYS142 - Fundamentals of Physics B.**Assessment:** Assignments: objectives i to v. CD ROM based tutorials: objectives i to iv. Tests: objectives i to v. Examinations: objectives i to v.**Subject Description:** Study of fundamental crystallography, structural defects, non-crystalline structures, structures of common metals, intermetallics, simple ceramics and polymers. Electrical, magnetic, optical, thermal and mechanical properties of materials and their relationships to structure will be discussed. Basic principles of techniques used to study structure will be introduced: optical microscopy, x-ray diffraction and scanning and transmission electron microscopy. Students will participate in tutorials and laboratory work related to these topics.**MATE202 Thermodynamics and Phase Equilibria 6cp****Autumn** Wollongong On Campus**Contact Hours:** 52**Pre-requisite:** CHEM103 - Introductory Chemistry for Engineers

**Assessment:** Assignments, laboratory reports, mid-session test, and final examination.

**Subject Description:** Laws of thermodynamics: energy, entropy and free energy; equilibrium in chemical systems; chemical potential; determination of thermodynamical quantities; thermodynamics of phase equilibria and construction of phase diagrams. Binary condensed systems; Gibbs phase rule: lever rule; types of equilibrium diagram; experimental determination of phase diagrams, microstructural development, non-equilibrium effects. Ternary condensed systems. Application of phase equilibria to metallic, ceramic and polymeric systems.

### MATE203 Phase Transformations 6cp

Spring Wollongong On Campus

**Contact Hours:** 52

**Co-requisite:** MATE201 - Structure and Properties of Materials

**Assessment:** Final examination and assignments.

**Subject Description:** Nucleation in liquid and solid states; thermodynamics of solidification; solidification of pure materials and alloys; thermal supercooling; constitutional supercooling; interface stability; solute redistribution; eutectic solidification; crystal growth techniques. Solid-state transformations - nucleation and growth of phases; Fick's laws of diffusion; diffusion mechanisms; transformation kinetics; transformation diagrams. Diffusional and diffusionless transformations: decomposition of solid solutions; ordering reactions, spinodal decomposition; eutectoid, massive, bainitic and martensitic transformations; crystallographic features; transformations in common alloy systems.

### MATE204 Mechanical Behaviour and Fracture 6cp

Spring Wollongong On Campus

**Contact Hours:** 52

**Pre-requisite:** MATE201 - Structure and Properties of Materials

**Assessment:** Assignments, laboratories, and final examination.

**Subject Description:** Theoretical strength; slip; twinning; deformation of single and poly crystals; dislocation multiplication; cross slip; climb; dislocation interactions. Strain hardening; solid solution hardening; dispersion hardening; grain size strengthening; other strengthening mechanisms.

High temperature deformation; creep; stress relaxation; effect of strain rate and temperature; plastic instability; super plasticity; viscoelastic behaviour. Fracture mechanics - fracture modes; plane stress and plane strain; notch effects; crack propagation; fracture toughness; high temperature fracture; fatigue and environmentally-assisted failure; design to minimise fracture.

### MATE291 Engineering Computing and Laboratory Skills 6cp

Autumn Wollongong On Campus

**Contact Hours:** 65

**Pre-requisite:** ENGG153 - Engineering Materials

**Assessment:** Assignments, tests, laboratory reports, and examination.

**Subject Description:** Introduction to basic laboratory techniques used to study structure and properties of materials.

Techniques include thermal treatment, reflected and transmitted light microscopy, basic x-ray diffraction, mechanical testing of metals, ceramics and polymers, and statistical analysis of data. Introduction to computer operating systems, application of spreadsheets to engineering problems, introduction to structured programming using flow-charts; data acquisition and control using the C-language. Information gathering and report writing skills will be further developed.

### MATE301 Engineering Alloys 6cp

Autumn Wollongong On Campus

**Contact Hours:** 52

**Pre-requisite:** MATE203 - Phase Transformations

**Assessment:** Laboratory reports, assignments and examinations.

**Subject Description:** Ferrous alloys - Phase transformations in ferrous alloys; binary and ternary additions to iron; strengthening mechanisms; ternary and multi component alloys; commercial steels and cast irons; hardenability Non-ferrous alloys - Physical metallurgy, processing and applications of commercially significant non-ferrous alloys Advanced alloys and processing - superalloys, superplastic alloys and metal-matrix composites. Design and selection of metallic materials on the basis of property requirements. Case studies.

### MATE302 Polymeric Materials 6cp

Autumn Wollongong On Campus

**Contact Hours:** 52

**Pre-requisite:** ENGG153 - Engineering Materials

**Assessment:** Tutorial assignments, quizzes, and final examination.

**Subject Description:** Review of polymerisation chemistry. Description of polymer structures from macromolecular to macroscopic; introduction to techniques for characterisation of polymer structures. Relationships between structure and properties of polymers, including mechanical, thermal, chemical, optical, electrical and rheological. Processing techniques for polymer products. Engineering design with polymers. Advanced polymers.

### MATE303 Ceramics, Glasses and Refractories 6cp

Spring Wollongong On Campus

**Contact Hours:** 39

**Pre-requisite:** MATE201

**Assessment:** Assignments: objectives i to iv. Tests: objectives i to iv. Seminar: objective iv. Processing project: objective iii. Examination: objectives i to iv.

**Subject Description:** Description of complex ceramic structures, including atomic and microstructural features of glass and crystalline ceramics, study of relationships between structures and physical and mechanical properties, methods for testing ceramics, industrial processing methods for ceramics, refractories, engineering ceramics, case study in design with brittle materials. A major process design project, in which students attempt to make a finished ceramic product which meets certain specifications forms a key part of the assessment.

**MATE304 Transport Phenomena in Materials Processes 6cp**

Spring Wollongong On Campus

**Contact Hours:** 52**Pre-requisite:** MATH283 Mathematics 2E for Engineers Part 1**Assessment:** Tutorials, quizzes, and final examination.**Subject Description:** Fluid dynamics - Properties of and types of fluids; laminar and turbulent flow; energy balances; conservation of energy; flow through packed beds; dimensional analysis; fluid flow measurement.

Heat and mass transfer - One and two dimensional heat conduction; radiation heat transfer; free and forced convection. Application of Ficks laws to diffusion in solids, liquids and gases; mass transfer coefficient; mass transport in fluid systems; interphase mass transfer; two-resistance theory. Applications of transport phenomena to a range of metallurgical processes.

**MATE305 Primary Materials Processing 6cp**

Spring Wollongong On Campus

**Pre-requisite:** MATE202 - Thermodynamics and Phase Equilibria**Assessment:** Assignments, laboratory, project, examination.**Subject Description:** Introduction to primary processing; raw materials and materials preparation for production of metals, ceramics and polymers; mineral processing ; production of metal oxides, clinkers and sinters. Study of metallurgical processes including iron and steelmaking, production of copper and aluminium. Introduction to polymerisation processes. The application of thermodynamics and kinetics to processing. Students will be involved in case study based projects, some laboratory work and visits to industrial sites.**MATE306 Degradation of Engineering Materials 6cp**

Spring Wollongong On Campus

**Contact Hours:** 52**Pre-requisite:** MATE202 - Thermodynamics and Phase Equilibria**Assessment:** Examination, tutorial assignments (some using interactive computer software), laboratory reports.**Subject Description:** Preliminary corrosion & electrochemistry; metals in equilibrium, thermodynamics of corrosion and dissolution, Pourbaix diagrams; Departures from equilibrium-kinetics of corrosion & the Evans diagram; types of corrosion, methods of measuring corrosion rates; Surface films & passivity; Corrosion prevention & control. Wear of materials; surface topography and its determination; origin of friction, influence of surface films and work hardening on friction; introduction to contact mechanics; wear mechanisms and wear maps; techniques for minimising wear. Design of materials for particular service environments.**MATE391 Materials Testing Techniques 6cp**

Autumn Wollongong On Campus

**Contact Hours:** 52**Pre-requisite:** MATE291 - Engineering Computing and Laboratory Skills**Assessment:** Logbooks, laboratory reports.**Subject Description:** This is a laboratory based subject designed to give students practical experience with a variety of testing techniques used to assess materials.

Techniques include thermal analysis, dilatometry, particle size analysis, and scanning electron microscopy and energy dispersive spectroscopy of x-rays. Principles of the techniques, data analysis and applications of the techniques to engineering problems such as failure analysis and phase transformations will be studied.

**MATE401 Selection of Materials in Engineering Design 6cp**

Autumn Wollongong On Campus

**Contact Hours:** 52**Pre-requisite:** MATE201 - Structure and Properties of Materials**Assessment:** Assignments, case study projects, examination.**Subject Description:** Engineering materials: properties, specifications and standards. Processes for shaping materials. Analysis of property - processing requirements for given applications. Design for recycling and sustainable development. Cost considerations in selection and design. Influence of shape factors in component design. Selection methodologies: performance indices, weighted property indices, value analysis, failure analysis and cost-benefit analysis.**MATE402 Secondary Materials Processing 6cp**

Spring Wollongong On Campus

**Contact Hours:** 52**Pre-requisites:** MATE202 - Thermodynamics and Phase Equilibria and MATE203 - Phase Transformations.**Assessment:** Assignments and final examination.**Subject Description:** Heat flow in solidification; solidification of castings and ingots; mould design; continuous casting, near-net-shape casting, squeeze casting, spray forming and other casting methods; grain refinement; as-cast microstructure and homogenisation; casting defects. Mechanics of deformation processing; flow stress determination; temperature and strain-rate effects; dynamic restoration mechanisms; friction and lubrication; residual stresses; deformation-zone geometry; microstructural modelling; control of microstructure; computer-aided programming. Industrial metalworking processes: rolling, forging, extrusion, drawing, and machining; production of polymers and ceramics.**MATE411 Advanced Materials and Processing 6cp**

Autumn Wollongong On Campus

**Contact Hours:** 39**Pre-requisites:** MATE201 - Structure and Properties of Materials and MATE203 - Phase Transformations.**Assessment:** Assignments and final examination.**Subject Description:** Study of advanced materials selected from: glassy, quasi crystalline and nano crystalline materials, magnetic, electronic, catalytic and bio sensing materials; intelligent, functionally gradient and environmental materials. Superplasticity, superelasticity and superconductivity. Metal, polymer and ceramic based composite and principles of reinforcement. Advanced processing methods selected from: rapid solidification, powder processing, near-net-shape forming, self-sustaining high temperature synthesis, biomimetic processing, sol-gel processing, zone refining and molecular beam epitaxy. Engineering applications of advanced materials and processing methods.

**MATE412 Electronic Materials 6cp**

Autumn Wollongong On Campus

**Contact Hours:** 42**Pre-requisites:** MATE201 - Structure and Properties of Materials or PHYS205 - Advanced Modern Physics or PHYS230 - Intermediate Physics.**Assessment:** Assignments, laboratory reports and examinations.**Subject Description:** The nature of electronic materials; Electrons in solids, band theory, insulators, conductors, semiconductors and superconductors. The free and nearly free electron theories. Electrical conductivity, hall effect. Types of magnetic materials. Semiconductors - intrinsic, extrinsic, the hole, the p-n junction. Superconductors - phenomena, BCS theory. Production of semiconductors and superconductors, control of processing to achieve desired properties. Design and production of novel materials to achieve improved performance in electronic devices; modern applications.**MATE413 Structural Characterisation Techniques 6cp****Contact Hours:** Not on offer in 2004**Pre-requisite:** MATE291 - Engineering Computing and Laboratory Skills**Assessment:** Assignments, seminars, laboratory practice and reports.**Subject Description:** Several advanced structural characterisation techniques will be introduced through lectures and laboratory classes. Topics may be selected from: electron microscopy - interactions of electrons with solids, electron optics, image formation and interpretation, scanning and transmission electron microscopy, energy dispersive spectroscopy, convergent beam electron diffraction, image contrast theory, thin foil microanalysis. Atomic force microscopy, X-ray diffraction and texture analysis. Studies of advanced materials characterisation techniques may also be included.**MATE421 Metallurgical Process Engineering 6cp****Contact Hours:** Not on offer in 2004**Pre-requisites:** MATE202 - Thermodynamics and Phase Equilibria**Assessment:** Assignments, case study and examinations.**Subject Description:** This subject provides an introduction to the principles of metallurgical process engineering. The underpinning scientific principles of metallurgical processing are used to elucidate operating procedures of industrial processes. Application of metallurgical thermodynamics to slag - metal equilibria during metallurgical processes. Study of pyrometallurgical refining of copper and the use of stability diagrams: electrolytic refining. Introduction to other non-ferrous processes such as aluminium and zinc production.**MATE422 Iron and Steelmaking 6cp**

Autumn Wollongong On Campus

**Pre-requisite:** MATE202 - Thermodynamics and Phase Equilibria**Assessment:** Assignments and examinations.**Subject Description:** The fundamentals of metallurgical thermochemistry and reaction kinetics are studied with a view to metallurgical process analysis in the iron and steelmaking industry, with an emphasis on ladle metallurgy.

Direct reduction of iron ore; single particle reduction kinetics and the analysis of shaft furnace operation leading to an analysis of the blast furnace. Analysis of industrial processes with emphasis on reactor design, smelting-reduction and ferro-alloy production. Principles of continuous casting.

**MATE431 Sheet Metal Processing 6cp****Contact Hours:** Not on offer in 2004**Pre-requisite:** MATE203**Assessment:** Assignments, laboratory report, mid-session examination, final examination.**Subject Description:** Plastic forming - Flow behaviour of sheet metals under uniaxial and biaxial stress; yielding criteria; plastic anisotropy. Shaping processes - Deep drawing; press forming; wall ironing and spinning; stretch forming; superplastic forming; workability; forming limit criteria; defects in formed parts; cutting; piercing and blanking. Surface finishing - Metallic, ceramic and polymeric coating of sheet materials; formability and defects in coated sheet. Case studies of forming of industrially significant sheet metals.**MATE432 Mechanical and Thermal Processing 6cp**

Spring Wollongong On Campus

**Contact Hours:** 52**Pre-requisites:** MATE301- Engineering Alloys and MATE304 - Transport Phenomena in Materials Processes.**Assessment:** Laboratory reports, assignments and final examination.**Subject Description:** Thermal treatment - Heat transfer in batch and continuous annealing; furnace design; heating efficiency; temperature control; heat treatment problems in engineering. Deformation and annealing - Polycrystalline plasticity; deformation microstructure and texture; stored energy; mechanisms of recovery and recrystallization; nucleation and growth of new grains; kinetics; effect of purity, solutes and particles; control of grain size; grain growth and secondary recrystallization; annealing textures; plastic and magnetic anisotropy; case studies.**MATE433 Surface Engineering 6cp****Contact Hours:** Not on offer in 2004**Co-requisite:** MATE306 - Degradation of Engineering Materials**Assessment:** Assignments, case studies and examinations.**Subject Description:** Classification of surface treatments, thermal, thermochemical, chemical vapour deposition, physical vapour deposition, thermal spraying, chemical and electrochemical processing; industrial engineering applications.**MATE441 Polymer Science 6cp****Contact Hours:** Not on offer in 2004**Pre-requisite:** MATE302 - Polymeric Materials**Assessment:** Examination, practicals and assignments.**Subject Description:** Detailed study of polymerisation reactions and control of molecular structure. Macromolecular conformations, shapes and entanglements. Solution properties of polymers. Rheological behaviour and viscoelasticity will be discussed using examples from industrial processes.

**MATE442 Polymer Processing 6cp****Contact Hours:** Not on offer in 2004**Pre-requisite:** MATE302 - Polymeric Materials**Assessment:** Examination, practicals and assignments.**Subject Description:** Study of polymer processing and fabrication methods including compounding, moulding and joining. Design of polymeric products. The influence of polymer properties (especially melt rheology) on processing performance will be discussed in detail. Environmental sustainability of polymers processing, including recycling, will also be studied.**MATE443 Advanced Polymers 6cp****Contact Hours:** Not on offer in 2004**Pre-requisite:** MATE302 - Polymeric Materials**Assessment:** Examination, practicals and assignments.**Subject Description:** Recent developments in the polymers field will be discussed including a description of the global polymer industry and recent examples of newly developed polymers, such as structural polymers, biomedical materials and conducting polymers. Students will undertake a detailed case study of the development of a new polymer from lab to final application as part of the assessment.**MECH152 Engineering Computing Instrumentation and Workshop Practice 6cp****Autumn** Wollongong On Campus**Assessment:** Final examination: objectives iii and iv. Laboratory reports: objective ii. Practical tasks: objective i. Other examination, assignments may be incorporated in the final assessment: objectives iii and iv.**Subject Description:** Introduction to practical methods and skills basic to mechanical fabrication; fitting and machining, welding and sheet metal work; elements of engineering instrumentation and mechanical measurement techniques applied to temperature, pressure, velocity, stress and displacement; introduction to computer operating systems; application of spreadsheets to engineering problems; introduction to structured programming using flow-charts; data acquisition and control using the C-language.**MECH201 Engineering Analysis 6cp****Spring** Wollongong On Campus**Contact Hours:** 5 per week**Pre-requisite:** MATH283 - Mathematics II E Part 1**Assessment:** Final examination: other short examinations; tutorials and assignments and projects may be incorporated in the final assessment: objectives i to iv.**Subject Description:** Analysis for the conservation of mass, momentum and energy in engineering systems; control volume analysis for the conservation of mass, momentum and energy in engineering systems; numerical methods for the solution for a selection of problems in fluid mechanics, heat transfer, solids mechanics, bulk solids and control systems; linear algebra; eigenvalue analysis; optimisation curve fitting; roots of equation; experimentation to validate engineering analysis.**MECH215 Fundamentals of Machine Component Design 6cp****Spring** Wollongong On Campus**Pre-requisite:** ENGG154 - Engineering Design and Innovation**Co-requisite:** ENGG251 - Mechanics of Solids**Assessment:** Final examination: objectives i, iii and iv. Other short examinations : objectives i, iii and iv. Project/Assignments: objectives i to iv.**Subject Description:** Design and Build Competition requiring team work, concept designs and final solution; design and analysis of fundamental machine components, such as limits and fits, bolted and welded connections, power screws, keys, spur and helical gears, brakes, clutches, bearings and failure theories for static and cyclic load conditions.**MECH226 Machine Dynamics 6cp****Spring** Wollongong On Campus**Pre-requisites:** MATH188 or MATH142 and ENGG152.**Assessment:** Final examination: objectives i to v. Other examinations, assignments and laboratory experiments may be incorporated in the final assessment: objectives i to v.**Subject Description:** Dynamics of rigid bodies and simple mechanisms in plane motion, kinematic analysis by vector and polygon methods, velocity analysis by instantaneous centres; kinetic analysis by superposition vector and force polygon methods, matrix method, method of virtual work; energy distribution method; kinematics of cam profiles; balance of rotors; introduction to CAD mechanism design; synthesis of a mechanism.**MECH311 Mechanical Engineering Design 6cp****Autumn** Wollongong On Campus**Pre-requisite:** MECH215 - Fundamentals of Machine Component Design**Assessment:** Final examination: objectives i to iii. Other short examinations/tutorials and assignments and design projects may be incorporated into the final assessment: objectives i to iii.**Subject Description:** Fatigue design including combined stresses, fracture mechanics and material selection. Contact stresses. Application of current design codes (eg for shaft design and rating helical and spur gears). Case studies incorporating cost estimation and evaluation, and project management. Students are required to analyse and propose solutions for a typical engineering problem drawn from the local industry.

The solution would normally involve a combination of innovative thinking and an integration of analysis tools provided in this and preceding subjects. A site visit is normally incorporated to clarify the link between the analytical work and the application to a real problem.

**MECH321 Dynamics of Engineering Systems 6cp****Autumn** Wollongong On Campus**Pre-requisite:** MATH283 - Mathematics IIE for Engineers Part 1**Co-requisite:** MECH226 - Machine Dynamics**Assessment:** Final examination: objectives i to v. Other examinations, assignments and laboratory experiments may be incorporated into the final assessment: objectives i to v.

**Subject Description:** Derivation of system equations for mechanical, electrical, thermo-dynamic and fluid-dynamic systems; analysis of linear, transverse and torsional vibration of mechanical systems; system classification; linearisation of system equations; linear time-invariant differential equations using transfer function representation analysis of system response in the time and frequency domain; simulation of dynamic systems.

**MECH341 Thermodynamics 6cp**

**Autumn** Wollongong On Campus

**Co-requisite:** ENGG252 - Engineering Fluid Mechanics

**Assessment:** Final examination: objectives i to iv. Quizzes: objectives i to iv. Laboratory experimental reports: objective iv.

**Subject Description:** Properties of pure substances; first law of thermodynamics, closed systems, control volumes; second law of thermodynamics;

entropy; second law analysis of engineering systems; power and refrigeration cycles; mixtures; psychrometrics and basic air conditioning.

**MECH343 Heat Transfer and Aerodynamics 6cp**

**Spring** Wollongong On Campus

**Pre-requisite:** ENGG252

**Assessment:** Final Examination: objectives i, iii, iv and iv. Mid-session quiz: objectives i and iii. Assignments: objective i to v. Laboratory Reports: objectives i to iii.

**Subject Description:** One and two dimensional heat conduction; forced convection; heat exchangers; radiation; boundary layer flows; flow around immersed bodies; one dimensional compressible flow with and without heat transfer; normal shock waves; compressible flow in pipes.

**MECH365 Control of Machines and Processes 6cp**

**Spring** Wollongong On Campus

**Pre-requisites:** MATH284 or MECH201 and MECH321.

**Assessment:** Final examination: objectives i to iv and vi. Other examinations, assignments and laboratory experiments may be incorporated in the final assessment: objectives i to vi.

**Subject Description:** Classical control system analysis and design concepts: transient response, steady-state error analysis, frequency domain analysis, root-locus controller design methods and frequency domain controller design methods; PLC programming.

**MECH372 Solids Handling and Process Engineering 6cp**

**Spring** Wollongong On Campus

**Pre-requisite:** MECH215 - Fundamentals of Machine Component Design

**Co-requisite:** ENGG252 - Engineering Fluid Mechanics

**Assessment:** Final examination: objectives i to iii. Other examinations and assignments may be incorporated in the final assessment: objectives i to iii.

**Subject Description:** An overview of bulk materials handling. Introduction to characterisation of bulk solid materials, gravity flow in hoppers and chutes, feeding and discharge devices, mechanical conveying, pneumatic conveying, dust control and dust explosions, and instrumentation and control for materials handling systems.

**MECH378 Sustainable Energy Technologies 6cp**

**Spring** Wollongong On Campus

**Pre-requisite:** ENGG252 - Engineering Fluid Mechanics

**Co-requisite:** ECTE290 - Fundamentals of Electrical Engineering

**Assessment:** Final examination: objectives i to iv. Short examinations: objectives i to iv. Projects/assignments: objectives i to v.

**Subject Description:** This subjects covers a number of Sustainable Energy Technologies including the following: solar thermal systems; photovoltaics; wind energy; hydroelectricity generation; wave power systems; biomass; remote area power supplies; energy conservation/auditing.

**MECH382 Manufacturing Engineering Principles 6cp**

**Autumn** Wollongong On Campus

**Pre-requisites:** MECH215 - Fundamentals of Machine Component Design and ENGG153 - Engineering Materials.

**Assessment:** Final examination: objectives i to vi. Assignments: objectives i to vi. Laboratory reports: objectives iv and v.

**Subject Description:** This course introduces students to the basic principles of manufacturing engineering. Topics include an overall perspective on manufacturing; life-cycle and environmental factors; interactions between product design, materials and manufacturing processes; machining processes; metal cutting theory and machinability; joining and assembly processes; computers in manufacturing, NC/CIM/FMS/IMS; introduction to component handling and industrial robotics; basic metrology and geometric tolerancing; process capability and quality control; machining economics; overview of non-conventional processes and advanced manufacturing trends.

**MECH417 Biomedical Engineering 6cp**

**Contact Hours:** Not on offer in 2004

**Assessment:** Mid-session quiz, assignments and final examination: objectives i to vii.

**Subject Description:** Introduction to Biomechanics, Anatomy and physiology, musculoskeletal system, human movement: function of muscles and nerves, ergonomics, heart and circulation. Dynamics of Human movement and strain rosette, advanced biomaterials. May include a visit to a biomedical manufacturer and laboratories.

Review of Research Problems in Biomechanics. Assumed prior knowledge - Mechanics of Solids (e.g. ENGG251).

**MECH418 Mechanical Behaviour of Engineering Materials 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** ENGG251 - Mechanics of Solids

**Assessment:** Final examination, mid-session quiz and tutorial assignments: objectives i and ii.

**Subject Description:** Review of the various forms of mechanical behaviour of materials. Development of tensorial stress, strain and elasticity. Physical basis for general materials behaviour and mathematical representation using constitutive equations for non-linear elasticity, plasticity, viscoelasticity and creep. Experimental and analytical approach to solutions of limit analysis for forming, ductile fracture and brittle fracture. Mechanisms of fatigue, friction and internal damping. Applications to engineering problems in product design, manufacturing operations, and reliability assessment.

**MECH419 Finite Element Methods in Engineering 6cp**

**Autumn** Wollongong On Campus

**Pre-requisites:** ENGG251- Mechanics of Solids and MECH201 - Engineering Analysis.

**Assessment:** Final examination, term project, mid-session quiz: objectives i and ii.

**Subject Description:** Review of solid mechanics fundamentals and of matrix algebra. Elementary derivation of finite element methods by variational principles, Galerkin method, and Rayleigh-Ritz technique. Finite element interpolation functions; natural and isoparametric coordinates.

Derivation of stiffness matrix for selected one-, two-, and three-dimensional elements. Derivation of strain-displacement relations and calculation of element stresses. Assembly and solution of system matrices; application of constraints and local coordinate systems. Introduction to structural dynamics and vibration problems, mesh generation, and finite element software in engineering applications.

**MECH420 Engineering Stress Analysis 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisites:** ENGG251 - Mechanics of Solids and MECH201 - Engineering Analysis.

**Assessment:** Final examination, mid-session quiz and tutorial assignments: objectives i and ii.

**Subject Description:** Introduction to the theory of elasticity in rectangular and curvilinear coordinates. Solution of elementary problems in plane stress and plane strain using Airy's stress function. Thermoelasticity. Elementary theory of plates and shells. Classical and numerical techniques for solution of boundary value problems.

**MECH421 Manufacturing Process Analysis 6cp**

**Autumn** Wollongong On Campus

**Pre-requisite:** MECH382-Manufacturing Engineering Principles

**Assessment:** Final examination, assignments and laboratory reports: objectives i and ii.

**Subject Description:** Comparative Process Analysis for Rolling, Casting, Forging & Forming; Advanced or 'Non-Traditional' Manufacturing; Joining & Welding;

Steel Rolling Technology & Analysis; Metals vs. Plastics Processing; Component Assembly and Disassembly; Automation and Component Handling; CAPP (Computer Aided Process Planning) and Process Optimisation; Process Integration into Manufacturing Systems; and Economic and Ecological Process Considerations.

**MECH422 Design and Analysis of Manufacturing Systems 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** MECH382-Manufacturing Engineering Principles

**Assessment:** Final examination: objectives i, ii and v. Short examinations and assignments: objective i to v. Project: objectives i to v.

**Subject Description:** Basic concepts and ideas of systems study with particular reference to their use in a manufacturing environment. Categories of manufacturing systems. Principles of the structure and operations of manufacturing systems and their elements (including the human component) especially those systems applied in discrete manufacturing. Techniques of systems analysis including computer simulations. Frameworks for applying systems analysis techniques to the design and analysis of advanced manufacturing systems including intelligent manufacturing systems and those associated with achieving enterprise integration, agile manufacturing and virtual enterprises. Plant layout and facility planning. Case studies and project work involving the design and analysis of advanced manufacturing systems.

**MECH423 Design for Manufacturing 6cp**

**Spring** Wollongong On Campus

**Pre-requisite:** MECH382-Manufacturing Engineering Principles

**Assessment:** Final examination: objectives i and iv. Other short examinations/tutorials and assignments may be incorporated in the final assessment.

**Subject Description:** Introduction to concurrent engineering; application and benefits; concurrent engineering applied to product development, product design, manufacturing process design, and manufacturing systems design; application of engineering tools including CAD, CAM, CAPP and rapid prototyping; design for machining, forming, casting, welding and assembly concepts; design efficiency; industrial ergonomics. General planning concepts in manufacturing; CAD/CAM and CIM/FMS.

**MECH424 Managing Manufacturing Activities 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** MECH382-Manufacturing Engineering Principles

**Assessment:** Final examination, group and individual assignments: objectives i to iv.

**Subject Description:** The problem of designing and managing a manufacturing activity, scope of manufacturing activities, demand forecasting, product design, capacity planning, scheduling, quality management, maintenance management, safety management, financial management, performance measurement, project presentation and reflection.

**MECH426 Storage and Flow of Bulk Solids 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** MECH372 - Bulk Solids Handling Technology

**Assessment:** Final examination and other short examinations, tutorials and assignments may be incorporated in the final assessment.

**Subject Description:** Characterisation of bulk solids and principles of granular flow; measurement and application of flow properties; bin and hopper flow patterns and geometries; chute design; flow rate predictions of coarse and fine powders; feeders and dischargers; bin wall pressures; mixing and segregation; case studies.

**MECH427 Mechanical Conveying of Bulk Solids 6cp**

Spring Wollongong On Campus

**Pre-requisite:** MECH372 - Bulk Solids Handling Technology

**Assessment:** Final examination: objectives i and ii. Other short examinations, tutorials, major design project/s and assignments may be incorporated in the final assessment.

**Subject Description:** Design, application and characteristics of mechanical conveyors including belt, screw, cable rope way, cable and disk, chain, vibratory and elevating conveyors; unit handling; Standards; safety and case studies.

**MECH428 Pneumatic Conveying and Dust Control 6cp**

Autumn Wollongong On Campus

**Pre-requisite:** MECH372 - Bulk Solids Handling Technology

**Co-requisite:** ENGG252 - Engineering Fluid Mechanics

**Assessment:** Final examination: objectives i to v. Other short examinations, tutorials, major design project/s and assignments may be incorporated in the final assessment.

**Subject Description:** Basic components of pneumatic transport systems; Modes of conveying; Models to predict conveying parameters; Dense-phase suitability; Conveying characteristics and scale-up procedures; Dust control health and safety requirements; Dust characterisation; Design and operating parameters for dust control systems; Duct networks.

**MECH429 Physical Processing of Bulk Solids 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** MECH372 - Bulk Solids Handling Technology

**Assessment:** Final Examination: objectives i to iii. Other short examinations, tutorials, major design project/s may be incorporated in the final assessment.

**Subject Description:** Bulk solids description and characterisation; process flow sheets; unit operation characteristics and power requirements: solid-solid, liquid-solid and gas-solid and multiphase-solid processes; batch, continuous or intermediate processing and handling; control and instrumentation; case studies.

**MECH430 Automotive Dynamics 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** MECH321 - Dynamics of Engineering Systems

**Co-requisite:** MECH365 Control of Machines and Processes

**Assessment:** Final examination and projects: objectives i to vi.

**Subject Description:** Introduction, dynamics associated with acceleration, braking, cornering and rollovers; occupant comfort and response; dynamics of multi-mode mechanical systems; component characteristics and interactions including cabin, chassis, steering and suspensions.

**MECH431 Computational Fluid Dynamics 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisites:** ENGG252 - Engineering Fluid Mechanics and MECH201 - Engineering Analysis.

**Assessment:** Final examination and projects: objectives i to v.

**Subject Description:** Introducing the finite difference and finite volume methods for computational fluid dynamics. Explicit and implicit methods for computation. Stability analyses. Validation of computational results. Analysis of engineering systems involving incompressible and compressible flow of fluid.

**MECH438 Fluid Power 6cp**

Spring Wollongong On Campus

**Pre-requisite:** ENGG252 - Engineering Fluid Mechanics

**Co-requisite:** MECH365 - Control of Machines and Processes

**Assessment:** Final examination: objectives i to iv. Other short examinations, tutorials and assignments and projects may be incorporated in the final assessment.

**Subject Description:** Characteristics of fluid power components for the provision of power and/or control in machines and mechatronic systems. Synthesis of systems, integration with Programmable Logic Controller (PLC) units and remote controllers. Industrial applications of fluid power, design application, case study.

**MECH439 Special Topics in Mechatronics 6cp**

Autumn / Spring Wollongong On Campus

**Assessment:** To be advised on the subject handout at the beginning of the session.

**Subject Description:** There is no set syllabus for this subject. It is intended to be offered normally on a specialised mechatronics topic given by members of the Faculty, visiting academic staff or engineering consultants.

**MECH440 Fluid Dynamics and Heat Transfer for Mechantronics 6cp**

Annual Wollongong On Campus

**Co-requisites:** MATH142 or MATH188.

**Assessment:** Final examination, mid session quizzes, tutorial assessments and laboratory work: objectives i to vi.

**Subject Description:** This subject is designed to introduce elementary fluid mechanics and heat transfer concepts to mechatronic engineers. The topics include fluid properties, hydrostatics, manometry, Bernoulli's, mass and energy, fluid flow in pipes and their applications and dimensional analysis; fundamentals of heat transfer and how to analyse situations involving heat transfer.

**MECH442 Sustainable Energy in Buildings 6cp**

**Contact Hour.s:** Not on offer in 2004

**Assessment:** Final examination: objectives i to vii. Assignments: objectives i to vi. Lab report: objective vii. Other quizzes and presentations may be included in the final assessment.

**Subject Description:** Fundamental principles of the performance of buildings with particular regard to thermal comfort and ventilation; analysis and design of conventional air conditioning systems to appropriate Australian Design Standards; passive solar design of buildings; energy conservation in buildings; embodied energy in buildings; natural ventilation systems; and refrigeration systems.

**MECH468 Computer Control of Machines and Processes 6cp**

**Autumn** Wollongong On Campus

**Pre-requisite:** MECH321 - Dynamics of Engineering Systems

**Co-requisite:** MECH365 - Control of Machines and Processes

**Assessment:** Final examination: objectives i to iii. Other short examinations, assignments, laboratory experiments may be incorporated in the final assessment: objectives ii and iii.

**Subject Description:** State-variable modelling; design of state variable feedback systems, controllability, observability, optimal control, pole placement using state feedback, internal model design; digital control systems, z-transform, stability analysis in the z-domain; performance and robustness of closed loop computer controlled systems, implementation aspects.

**MECH474 Systems Engineering and Life Cycle Management 6cp**

**Intake D** Wollongong On Campus

**Assessment:** Final examination: objectives i to v. Other short examinations, assignments, laboratory experiments may be incorporated in the final assessment.

**Subject Description:** Phases of life cycle of products and industrial equipment, life cycle costing, economics and models, manufacturing and environmental considerations, cost estimations, analysis and design, logistic support, maintainability, availability, interface control, system integration, testing and performance evaluation, installation procedures, asset management, disposal purchase/replacement policies and decision making.

**MECH479 Sustainable Transport and Engine Technologies 6cp**

**Autumn** Wollongong On Campus

**Pre-requisites:** MECH341- Thermodynamics and MECH226 - Machine Dynamics.

**Assessment:** Final examination: objectives i to iv. Other short examinations, assignments, laboratory experiments may be incorporated in the final assessment.

**Subject Description:** Human powered transport; conventional and novel engine technology design, analysis and evaluation; strategies for reducing emissions; fuel supplies and alternative fuels; electric and hybrid vehicles; solar vehicles; fuel cells.

**MECH481 Special Topics in Mechanical Engineering 1 6cp**

**Spring** Wollongong Flexible

**Autumn** Wollongong On Campus

**Assessment:** To be advised on the subject handout at the beginning of the session.

**Subject Description:** There is no set syllabus for this subject. It is intended to be offered normally on a specialised mechanical engineering topic given by members of the Department, visiting academic staff or engineering consultants.

**MECH482 Special Topics In Mechanical Engineering 2 6cp**

**Autumn / Spring** Wollongong On Campus

**Assessment:** To be advised on the subject handout at the beginning of the session.

**Subject Description:** There is no set syllabus for this subject. It is intended to be offered normally on a specialised mechanical engineering topic given by members of the Department, visiting academic staff or engineering consultants.

**MECH487 Systems Analysis for Maintenance Management 6cp**

**Autumn** Wollongong On Campus

**Pre-requisite:** MATH283-Mathematics 2E for Engineers Part 1

**Assessment:** Final examination, individual assignment and group assignment: objectives i to vi.

**Subject Description:** Maintenance Requirements Analysis Methodology, Qualitative Methods of Failure Mode Identification, Reliability Theory for Systems, Reliability Data Analysis, Preventive Replacement Policies, Selection of Inspection Intervals, Grouping of Maintenance Actions, Repair/Replace Decisions, Practical considerations in Maintenance Requirements Analysis, Auditing Maintenance Requirements Analysis outcomes.

**MECH488 Introduction to Condition Monitoring in Mechanical Engineering 6cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisite:** MECH226 - Machine Dynamics

**Assessment:** Final examination: objectives i to iv. Assignment and other quizzes and tutorials may be incorporated in the final assessment.

**Subject Description:** Introduction to Condition Based Maintenance (CBM); Tribology and Condition Based Maintenance; Condition Monitoring using Signal Diagnostics; CBM of Bearings, Pumps, Fans, Motors, Gearboxes, Hydraulic and Electrical Equipment; Failure Case Studies and Issues in Implementation; Artificial Intelligence in Condition Monitoring.

**MECH489 Maintenance Management 6cp**

**Spring** Wollongong On Campus

**Pre-requisite:** ENGG361 - Engineering Management

**Assessment:** Final examination, individual assignment and group assignment: objectives i to iii.

**Subject Description:** Approaches to maintenance, The Systems Approach, Life cycle considerations for systems, refining maintenance - A maintenance model, Analysing Maintenance Requirements: The Process, The Business Environment, Safety and Quality Standards, System Analysis, Failure Behaviour, Condition Monitoring, Maintenance Planning and Control, Inventory selection and control, Human factors and organisational aspects for maintenance, The information flows, documentation and computer control in maintenance.

**MINE221 Underground Coal Mining 6cp**

**Autumn** Wollongong On Campus

**Assessment:** Assignments/Seminars: objectives i to vi. Mid-session examination: objectives i to vi. 2 hour final examination: objectives i to vi.

**Subject Description:** Access to underground coal seams, Coal mining methods; bord and pillar, longwall, miniwall, thick seam, multi-seam and horizon mining and highwall mining. Mechanisation; powered loaders and coal cutting technology, coal transport to include chain and belt conveyors, man and material transport, rope haulage and hoisting. Ventilation systems and field visits.

**MINE311 Surface Mining and Blasting 6cp**

**Spring** Wollongong On Campus

**Assessment:** Assignments/seminars: objectives i to iv. Mid-session examination: objectives i to iv. 2 hour final examination: objectives i to iv.

**Subject Description:** Surface mining operations; alluvial mining, hydraulic mining, and dredging; strip mining of bedded deposits, surface mining of massive deposits, quarrying. Loading and transport of rocks and minerals. Drilling and blasting. Classification of explosives used in mines. Properties of explosives. Theories of detonation and blasting. Initiation of explosives. Blasting accessories. Systems of firing and blast design. Controlled blasting. Noise and vibration. storage, transport and handling of explosives. Misfires and accident prevention. Regulations.

**MINE312 Mine Ventilation 6cp**

**Contact Hours:** Not on offer in 2004

**Assessment:** Final examination: objectives i, ii, iv and v. Mid-session examination: objectives i, ii, iv and v. Tutorials: objectives i, ii, iv and v. Laboratory: objectives i, ii and vi.

**Subject Description:** Mine air; pressure, temperature and humidity, sampling. General principles of ventilation; natural and artificial ventilation. Fans; axial and centrifugal. Fan characteristics and operations. Fan combinations and analysis. Booster and auxiliary fans. Ventilation surveying and planning. Network analysis. Application of computers to mine ventilation. Heat in mines, its physiological and psychological effects. Mine air conditioning and refrigeration. Elements of mine thermodynamics. Ventilation. Laboratory experiments.

**MINE321 Underground Metal Mining 6cp**

**Contact Hours:** Not on offer in 2004

**Assessment:** Assignments/seminars: objectives i to vi. Mid-session examination: objectives i to vi. 2 hour final examination: objectives i to vi.

**Subject Description:** Underground Metalliferous ore deposit development, mining methods for regular and irregular deposits; open and supported stoping, sub level stoping, VCR, cuts and fill stoping, shrinkage stoping, block caving. Blasting and stope ventilation, Mechanisation to include drilling machines, LHD, track and Trackless transport. Pumps and Compressors, regulations and field visits.

**MINE323 Mining Geomechanics 6cp**

**Contact Hours:** Not on offer in 2004

**Assessment:** 2 hour final examination: objectives i to v. Assignments and short examination will be taken into consideration: objectives i to v.

**Subject Description:** Mechanical properties of rock, insitu properties of rock mass, index properties of rocks, pre-mining state of stress. Stress distribution around underground openings. Excavation design in massive elastic rock, stratified rock and jointed rock. Support and reinforcement - pillar design, rock bolting systems, passive support systems, longwall powered supports and mine backfill. Surface subsidence and methods of limiting damage due to subsidence. Rock bursts and bumps. Monitoring rock mass performance. Laboratory experiments.

**MINE411 Health & Safety In Mines 6cp**

**Autumn** Wollongong On Campus

**Pre-requisites:** MINE221 - Underground Coal Mining, MINE311- Surface Mining and Blasting, MINE321- Underground Metal Mining.

**Assessment:** 2 hour final examination: objectives i to iii. Assignments and short examination will be taken into consideration: objectives i to iii.

**Subject Description:** Gases in mines - firedamp emission and control, layering of mine gases. Spontaneous combustion. Dust and dust suppression. Fires and explosions. Measurement and control of noise. Rescue and recovery. Government regulations - coal and metalliferous mine regulations and acts, occupational health and safety act. Legal aspects of mining lease and legal responsibilities of mining engineers. Safety and accident avoidance. Optimising production without compromising safety.

**MINE412 Mining Economics 6cp**

**Contact Hours:** Not on offer in 2004

**Assessment:** Assignments/seminars: objectives i to iii. Mid-session examination: objectives i to iii. 2 hour final examination: objectives i to iii.

**Subject Description:** Valuation of mineral properties and mining prospects: global and local block reserves by traditional methods. Interaction of grade, tonnage, mining recovery and mining method. Introductory geostatistics. Project evaluation techniques: cash flow models, mineral taxation, tariffs, smelter agreements and accounting for inflation and risks. Marketing of mineral commodities.

**MINE421 Minerals Benefication 6cp**

**Autumn** Wollongong On Campus

**Assessment:** Final examination: objectives i to v. Class test: objective i to vi. Tutorials: objectives iii to v. Laboratory and project reports: objectives i to vi.

**Subject Description:** The subject is designed to provide students with detailed knowledge of the art of processing raw minerals to yield marketable products using physical, chemical and electromagnetic techniques. The course contents will cover: Metallic and non-metallic ore, process flow charts and unit operations, sampling systems, slurry streams and mass balancing, concentration and recovery, net smelter return, particle size analysis, liberation and comminution, crushing and grinding, screening, classification, gravity concentration, flotation, dewatering, tailings disposal and industrial re-use.

The lectures and tutorials will be complemented with laboratory tests, project work and a field trip.

### MINE422 Mine Planning and Development 6cp

Spring Wollongong On Campus

**Assessment:** No formal examinations. Assignments and submission of a mine project report: objectives i to iv.

**Subject Description:** Each student will be given basic information of a mining prospect including borehole data, surface topography and projected output. The student will be required to submit a comprehensive report of the mine project together with appropriate plans.

### MINE431 Mine Water 6cp

**Contact Hours:** Not on offer in 2004

**Assessment:** 2 hour final examination: objectives i to v. Other short examinations/tutorials/projects may be taken into consideration: objectives i to v.

**Subject Description:** Origin and hydro-geological aspects of mine water. Salinity problems. Acid mine drainage. Drainage in open pit mines. Drainage control in underground mine. Mine drainage design and calculations. Elements of tailings dam construction. Pollution case histories.

### MINE433 Geostatistical Ore Reserve Estimation 6cp

**Contact Hours:** Not on offer in 2003

**Assessment:** Final examination: objectives i to iii. Class test: objectives i to iii. Assignments: objectives i to iii.

**Subject Description:** Review of statistical measures, outliers, and the desirable properties of an estimator. Basic concepts: regionalised variables, stationarity and intrinsic hypothesis.

Variograms and structural analysis: calculation and interpretation experimental variograms and fitting theoretical models. Use of volume variance relationships. Estimation variance: sampling programs, optimal drill hole positions. Theory and practice of kriging: estimation at grid node and over block, total, and average grade. Recoverable reserves.

### MINE434 Special Topics in Mining Engineering 6cp

Spring Wollongong On Campus

**Assessment:** Final examination: objectives i to v. Class test: objectives i to vi. Tutorials: objectives iii to vi. Laboratory and project reports: objectives i to vi.

**Subject Description:** There is no set syllabus for this subject. It is intended that it normally be offered on a specialised mining engineering topic given by members of the Department or visiting academic staff or engineering consultants.

### MINE438 Environmental Impact of Mineral Operations 6cp

**Contact Hours:** Not on offer in 2004

**Assessment:** 2 hour final examination: objectives i to v. Assignments and short examination will be taken into consideration: objectives i to v.

**Subject Description:** Environmental impact of surface and underground mining - visual impact assessment, air pollution, noise and vibration. Waste solids management, water pollution and acid drainage. Restoration of mine sites, land use, subsidence and socio-economic effects of mining. Field Visits.

### PHYS131 Physics For the Environmental and Life Sciences A 6cp

Autumn Wollongong On Campus

**Contact Hours:** 6 hours per week

**Assessment:** Sessional written examination, written tests, one essay/poster paper, performance in laboratory and tutorials.

**Subject Description:** This course provides an awareness of the physical principles underlying locomotion, gas and fluid transport, and temperature control in living organisms. In addition, principles relating to the environmental impact of human activities are discussed. An emphasis is placed on the physical principles involved and examples drawn from the biosciences wherever possible.

### PHYS132 Physics For the Environmental and Life Sciences B 6cp

Spring Wollongong On Campus

**Contact Hours:** 6 hours per week

**Assessment:** Sessional written examination, written tests, one essay/poster paper, performance in laboratory and tutorials.

**Subject Description:** This course introduces the physical principles underlying the uses of light, lasers and radar measurement in remote sensing as well as the assessment of nuclear-radiological hazards. It covers topics in wave phenomena, principles of electrical measurements, atomic and molecular physics and nuclear physics with an emphasis on the physical principles involved and examples drawn from the biosciences.

### PHYS141 Fundamentals of Physics A 6cp

Autumn Wollongong On Campus

**Contact Hours:** 6 hours per week

**Co-requisites:** MATH141 or MATH187.

**Assessment:** Performance in assignments, practical work, tests and sessional examinations.

**Subject Description:** Vectors; vector algebra; motion in one dimension; motion in a plane; particle dynamics; work and energy; conservation of energy; conservation of momentum; collisions; rotational kinematics; rotational dynamics; conservation of angular momentum; equilibrium of rigid bodies; simple harmonic motion; gravitation; elasticity; temperature; heat and the first law of thermodynamics; kinetic theory of gases; entropy and the second law of thermodynamics; fluid statics; fluid dynamics.

### PHYS142 Fundamentals of Physics B 6cp

Spring Wollongong On Campus

**Contact Hours:** 6 hours per week

**Co-requisites:** MATH142 or MATH188.

**Assessment:** Performance in assignments, practical work, tests and end of session examinations.

**Subject Description:** Vectors and their applications; charge and matter; electric field; Gauss's Law; electric potential; capacitance; current and resistance; emf and circuits; magnetic fields; Ampere's Law; Faraday's Law; inductance; waves; reflection and refraction; interference; diffraction; polarization; optical instruments; quantum physics; waves and particles; atomic physics; the Bohr atom.

**PHYS143 Physics For Engineers 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Co-requisites:** MATH142 or MATH188.

**Assessment:** Performance in assignments, practical work, tests and end of session examinations.

**Subject Description:** Vectors and their applications; an introduction to the physical laws of electricity and magnetism, leading to an explanation of the generation of electromagnetic waves and some basic ideas in communication theory. Electric charge and Coulomb's law, electric fields, potential differences, capacitance, dielectrics and relative permittivity, electric current, resistance, Ohm's "law", superconductivity, DC circuits and Kirchhoff's laws, magnetic fields and forces, electromagnetic waves and the EM spectrum, carrier waves, modulation and bandwidth. Waves; reflection and refraction; interference; diffraction; polarization; optical instruments; quantum physics; waves and particles; atomic physics; the Bohr atom.

**PHYS205 Advanced Modern Physics 6cp**

**Autumn** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Pre-requisites:** PHYS141 and PHYS142.

**Assessment:** Final assessment is determined by a weighting factor based on the contact hours of each section. Based on performance in homework assignments, tests, laboratory work and sessional exams.

**Subject Description:** Special relativity; Lorentz transformations; quantum effects; atomic structure; wave-particle duality; black body radiation; photo-electric effect; bremsstrahlung; Compton effect; X-rays; de Broglie hypothesis, particle diffraction; quantum mechanics; wave packets; uncertainty principle; Schrodinger equation; correspondence principle; particle in a box; wave functions of the hydrogen atom; nuclear particles, decay laws;

binding energy; nuclear reactions; fission and fusion; statistical distribution functions; energy bands; impurity states; p-n junction and transistor.

**PHYS206 Project in Physics 6cp**

**Autumn / Spring** Wollongong On Campus

**Annual** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Pre-requisites:** Normally performance in 100-level Physics and Mathematics subjects at the level of distinction or better.

**Assessment:** Based on satisfactory written progress reports during the project and a written description on completion.

**Subject Description:** Option 1 and Option 2 Dbl (A)/Aut/Spr.

**PHYS215 Vibrations, Waves & Optics 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Pre-requisites:** PHYS141 and PHYS142.

**Assessment:** Determined from the assessment of each section separately. Final assessment is determined by a weighting factor based on the contact hours of each section. Based on performance in exams, assignments and laboratory work.

**Subject Description:** Simple harmonic motion; two body oscillations; damped harmonic oscillator; power dissipation; quality factor; driven harmonic oscillator; superposition principle; Fourier analysis; Huygens' principle; reflection and refraction; wave motion; sinusoidal waves; group velocity; dispersion; Young's experiment; interference; coherence; Stokes' treatment of reflection and refraction; interference; standing waves; Fabry-Perot interferometer; Michelson interferometer; Fourier spectroscopy; Fresnel diffraction; Fraunhofer diffraction; resolving power; diffraction grating; holography; polarization of waves; double refraction; interference of polarized light.

**PHYS225 Electromagnetism and Optoelectronics 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Pre-requisites:** PHYS141, PHYS142, MATH201.

**Assessment:** Test, examinations, laboratory work and assignments.

**Subject Description:** Lectures cover, in detail, the fundamental experimental laws of electromagnetism, how these relate to the electrical and magnetic properties of materials and finally lead to the four Maxwell field equations. Plane wave solutions to Maxwell's equations in free space and the properties of these waves. Coulomb's and Gauss' laws, potential, capacitance, properties of dielectrics, field calculations, steady currents magnetism, Biot-Savart law, Ampere's law, magnetic properties of materials, Faraday's law, inductance, charge continuity equations, Maxwell's equations, plane waves in free space. The associated electronics laboratory consists mainly of experimental work, combined with some lectures and tutorials, covering the physics of p-n junction diodes and transistors, simple device models, AC theory, transistor amplifiers, operational amplifiers and their use in a variety of elementary circuits (amplifiers, adders, integrators, differentiators).

**PHYS230 Intermediate Physics 12cp**

**Contact Hours:** Not on offer in 2004

**Pre-requisites:** PHYS141 and PHYS142 or PHYS144 and PHYS145.

**Co-requisites:** MATH284 or MATH201 and MATH202.

**Assessment:** Assessment is based on performance in homework assignments, tests, lab work and sessional exams.

**Subject Description:** As for the subjects PHYS205, PHYS215 and PHYS225.

**PHYS233 Introduction to Environmental Physics 6cp****Autumn** Wollongong On Campus**Contact Hours:** 3 hours per week**Assessment:** Exam, Assignments and Fieldwork.

**Subject Description:** This subject is based on a sequence of modules, each of which introduces a key environmental physics theme illustrated using case studies. Students will be introduced to simple systems modelling utilising spread sheet analysis. The key areas studied are: (i) Atmospheric gases and vapours. (ii) Thermal radiation and the environment. (iii) Hydrodynamics of air, water and particulates. (iv) Hydrology of soils and porous materials.

**PHYS235 Mechanics & Thermodynamics 6cp****Autumn** Wollongong On Campus**Contact Hours:** 6 hours per week**Pre-requisites:** PHYS141 and PHYS142.**Co-requisites:** MATH201 and MATH202.

**Assessment:** Assessments determined from each section separately. Final assessment determined by weighting factor based on contact hours of section. Assessment based on performance in homework assignments, tests, lab work and sessional exams.

**Subject Description:** Vector calculus; kinematics of a particle; dynamics of a particle; moving reference systems; central forces; dynamics of a system of particles; mechanics of rigid bodies; Lagrange's Equations. Thermodynamic systems; equations of state; work; the first law of thermodynamics and its consequences; the second law of thermodynamics; entropy; combined first and second laws; thermodynamics potentials; applications of thermodynamics; kinetic theory of the ideal gas; molecular velocity distribution.

**PHYS255 Radiation Physics 6cp****Spring** Wollongong On Campus**Contact Hours:** 6 hours per week**Pre-requisites:** PHYS131 and 132 or PHYS141 and 142.

**Assessment:** Assessment: sessional written examination, performance in laboratory, assignments and sessional report on ANSTO visit.

**Subject Description:** Different types of radiation; Interaction between radiation and matter; Nuclear reactor and particle accelerator based applications in biology, medicine and physics; Nuclear reactions and the production of radioisotopes; Nuclear instrumentation; Application of radio-isotopes in biology, chemistry, medicine and physics; Use of neutrons in biology, chemistry, physics and in industry.

**PHYS262 Vibrations and Waves 3cp****Spring** Wollongong On Campus**Contact Hours:** 6 hours per week**Pre-requisites:** PHYS141 and PHYS142.

**Exclusions:** Cannot count with PHYS215 Vibration/waves and Optics.

**Assessment:** Final examination, practical work and tutorial problems.

**Subject Description:** A. background to vibrations including: Simple harmonic motion; two body oscillations; damped harmonic oscillator: power dissipation; quality factor; driven harmonic oscillator; superposition principle; Fourier analysis.

B. background to wave motion and their interactions including topics on: wave motion; sinusoidal waves; Huygens' principle; reflection and refraction; group velocity; dispersion.

**PHYS263 Photonics and Communications 6cp****Autumn** Wollongong On Campus**Contact Hours:** 6 hours per week**Pre-requisites:** PHYS141 and PHYS142.**Exclusion:** PHYS215 - Vibrations, Waves and Optics.

**Assessment:** Final examination; Practical work; and Tutorial problems.

**Subject Description:** The subject will consist of the following modules: 1. Electromagnetic waves: Waves and photons 2. Geometric optics 3. Interference: Amplitude and Wavefront Division 4. Fraunhofer and Fresnel Diffraction: Fourier Optics 5. Diffraction Gratings and Interferometers: Spectrometers 6. Coherence 7. Lasers 8. Fibre Optics 9. Detectors

**PHYS295 Astronomy - Concepts of the Universe 6cp****Spring** Wollongong On Campus**Contact Hours:** 4 hours per week**Pre-requisite:** 24 credit points at 100-level.

**Assessment:** Performance in tests, written assignments and one 2 hr examination.

**Subject Description:** This subject takes a non-mathematical approach to Astronomy. No prior knowledge of physics is required to do the subject. This course will illustrate the techniques used by astronomers and will attempt to give an understanding of the universe as we presently understand it. The use of telescopes will give the opportunity to observe the phenomena discussed.

The development of astronomy; the planets; the formation of the solar system; the sun as a star; the message of starlight; the visible stars; the birth and death of stars; telescopes, big and small; the milky way; the universe of galaxies.

**PHYS305 Quantum Mechanics 6cp****Autumn** Wollongong On Campus**Contact Hours:** 6 hours per week**Pre-requisites:** PHYS205 or PHYS230.

**Assessment:** Laboratory work 35%, homework assignments 15% and end of session examination 50%.

**Subject Description:** The course is an introduction to the wave mechanical theory of quantum mechanics and some applications to simple systems. Probability, the Wave Function, Schrodinger's equation in one dimension, normalisation, expectation values, operators. The time-independent Schrodinger equation, application to various potential functions, tunneling. QM in three dimensions, degeneracy, the hydrogen atom. Time independent perturbation theory, angular momentum and spin, identical particles; atoms, solids and quantum statistics.

**PHYS306 Project in Physics** **6cp**  
**Autumn / Spring** Wollongong On Campus  
**Contact Hours:** 6 hours per week  
**Pre-requisites:** Normally performance in 200-level Physics and Mathematics subjects at the level of distinction or better.  
**Assessment:** Assessment is based on satisfactory written progress reports during the project and a written description on completion.  
**Subject Description:** Option 1 and Option 2 Dbl (A)/Aut/Spr.

**PHYS325 Electromagnetism** **6cp**  
**Autumn** Wollongong On Campus  
**Contact Hours:** 64  
**Pre-requisites:** PHYS225 or PHYS230.  
**Assessment:** Laboratory work (35%), end-of-session examination (30%), homework assignments (20%) and an essay (15%).  
**Subject Description:** Starting with the Maxwell field equations, the course examines the properties of electromagnetic waves in free space, non-conducting and conducting materials, waveguides and plasmas. Reflection and refraction, particularly total internal reflection, are covered in detail. The generation of electromagnetic waves by accelerating charge is treated via the Lienard - Wiechert potentials and Feynman's equation. Revision of charge continuity, Maxwell's equations, boundary conditions. EM waves in free space and materials. Reflection and refraction, Snell's law and the Fresnel equations, total internal reflection and evanescent waves. Waveguides, TE and TM modes, cut off frequency. Generation of EM waves, Lienard-Wiechert potentials, Feynman equation and its application to simple systems: far-field dipole and synchrotron radiation fields.

**PHYS335 Classic Mechanics** **6cp**  
**Autumn** Wollongong On Campus  
**Contact Hours:** 6 hours per week  
**Pre-requisite:** PHYS235  
**Assessment:** End of session examination and tutorial assignments 66% and practical, 34%.  
**Subject Description:** Subject covers: vectors and matrices; the special theory of relativity; motion in a non-inertial frame; dynamics of rigid bodies; Euler's Angles; Euler's Equations and applications; small oscillations; normal modes; Lagrange's equations of motion; Hamiltonian dynamics.

**PHYS356 Physics of Detectors and Imaging** **6cp**  
**Autumn** Wollongong On Campus  
**Contact Hours:** Not on offer in 2004  
**Exclusion:** PHYS452 - Medical Imaging  
**Assessment:** Image analysis labs 20%; Review paper 30%; End of Session Exam 30%; Project 20%.  
**Subject Description:** This course leads to an understanding of the instrumentation and techniques involved in imaging and their role in medical physics specifically and in physics. The photographic process, Solid state detectors and CCD's, Characterisation of detectors; signal to noise sensitivity, Calibration of 2-D detectors eg. response curves, flat fields and reduction techniques;

The hardware and software of image digitisation; film digitisers, plate scanners and A/D converters, Image processing techniques: spatial filters, histogram enhancement, fourier and other transforms, Examples of imaging technologies e.g. Side looking radar, Confocal microscopy, Radiography and CT scanning, Ultrasonics, Sonar, NMR.

**PHYS363 Advanced Photonics** **6cp**  
**Contact Hours:** Not on offer in 2004  
**Pre-requisites:** PHYS263 - Photonics and Communication and 1 subject of 200-level Mathematics or PHYS215.  
**Assessment:** Written examinations, assignments and a practical seminar.  
**Subject Description:** Optical Design and Fabrication, Light Sources and Lasers, Photonic Materials, Quantum optics and Nanostructures, Opto-mechanical and Electro-optical Devices, materials Diagnostics, Advanced Metrology.

**PHYS365 Detection of Radiation: Neutrons, Electrons and X Rays** **6cp**  
**Autumn** Wollongong On Campus  
**Contact Hours:** Not on offer in 2003.  
**Pre-requisites:** PHYS205 or PHYS230 or PHYS255.  
**Assessment:** 3 Assignments, Labs and Final Exam.  
**Subject Description:** Cylindrical and parallel plate ionisation chambers and their optimised design. Absolute dose calibration protocols and the relative dose concept. Semiconductor detectors and their response to radiation. Thermoluminescent dosimeters - their properties, types and advantages. Film dosimetry - the principles of radiation film exposure and non-linearity of film response, EPR dosimetry and chemical dosimetry.

**PHYS366 Physics of Radiotherapy** **6cp**  
**Autumn** Wollongong On Campus  
**Contact Hours:** 6 hours per week  
**Assessment:** Written examination, Assignments, Practical.  
**Subject Description:** This subject is intended to lead to an understanding of the techniques involved in diagnostic and therapeutic uses of radioactive isotopes in medicine. Topics covered will include: A review of homeostasis and cellular functions, epidemiology of disease; abnormal cell growth; benign and malignant tumours; cell kill; introduction to particle accelerators; medical linear accelerators; the interaction properties of X-rays and electrons; clinical radiotherapy, linear accelerator x-ray and electron beam properties; the radiotherapy computer planning process, x-ray modelling methods and brachytherapy and radiosurgery.

**PHYS375 Nuclear Physics** **6cp**  
**Spring** Wollongong On Campus  
**Contact Hours:** 6 hours per week  
**Pre-requisite:** PHYS205  
**Co-requisites:** PHYS305 and PHYS385.  
**Assessment:** Assessment will be based on a group case study, spreadsheet exercises, tutorial problems and a final examination.

**Subject Description:** Topics presented will be selected from: 1. Nuclear characteristics: radius, charge, mass, composition, energy levels, angular momentum. 2. Nuclear models: liquid drop, semi-empirical and shell models 3. nuclear interactions and the compound nucleus. 4. Radioactive decay including alpha, beta and gamma emission. 5. Fission and chain reactions. 6. Fission reactors and radioactive waste. 7. Nuclear fusion and stellar nuclear processes. 8. Particle accelerators. 9. Elementary particles: protons to quarks.

**PHYS385 Statistical Mechanics 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Pre-requisites:** PHYS205 or PHYS230.

**Assessment:** Assessment: Laboratory work; Homework assignments; End of session examination.

**Subject Description:** Review of thermodynamics, quantum statistical mechanics; sharply peaked distributions, ensembles; entropy and temperature; the chemical potential; Gibbs and Boltzmann factors - partition functions; fluctuations; pressure and thermodynamic identity; Boltzmann definition of entropy; identical particles - fermion and boson distribution functions; applications to electrons in metals; blackbody radiation and Debye theory of vibrations in solids; classical limit of the quantum distribution functions; monatomic ideal gas; Maxwell-Boltzmann velocity distribution; kinetic theory; transport processes.

**PHYS390 Astrophysics 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Pre-requisites:** PHYS205

**Assessment:** Assignments, sessional examination and poster paper.

**Subject Description:** Two strands will be presented on alternate years 1. Observational Astrophysics- Modern observational astrophysics involves observing across a wide range of wavebands from the X-ray and Gamma Rays through visible light and into the infrared and radio. To do this requires a broad understanding of optics, detector physics, astronomical database and analysis software. 2. Theoretical Astrophysics- Key topics will be selected from: Cloud collapse, Star formation and radiative transfer, Main sequence stellar models, Stellar evolution, Galaxy evolution, Cosmology.

**PHYS396 Electronic Materials 6cp**

**Spring** Wollongong On Campus

**Contact Hours:** 3 hours per week

**Pre-requisite:** PHYS205

**Co-requisite:** PHYS305

**Assessment:** Assignments, laboratory reports, exam.

**Subject Description:** The nature of electronic materials. Electrons in solids, band theory: insulators, conductors, semiconductors and superconductors. The free and nearly free electron theories. Electrical conductivity, Hall effect. Types of magnetic materials. Semiconductors - intrinsic, extrinsic, the hole, the p-n junction. Superconductors - phenomena, BCS theory. Production of semiconductors and superconductors, control of processing to achieve desired properties.

Design and production of novel materials to achieve improved performance in electronic devices; modern applications.

**PHYS401 Theoretical Mechanics & Electromagnetism 8cp**

**Autumn** Wollongong On Campus

**Contact Hours:** 4 hours per week

**Pre-requisites:** The main programs in physics at 400-level are directed toward the Honours BSc qualification and BMedPhys. Full time Honours BSc students will normally enrol in PHYS405. Honours BMedPhys students will enrol in the Bachelor of Medical Physics program.

**Assessment:** Two sessional examinations and assignments.

**Subject Description:** Theoretical mechanics: holonomic constraints, d'Alembert's principle and Lagrange's equations; generalised potentials; variational approach and Hamilton's principle; symmetry and conservation laws; central force problem; Hamiltonian formulation of mechanics; principle of least action; canonical transformations; Poisson brackets; canonical invariants; Liouville's theorem; Hamilton-Jacobi theory; action-angle variables; classical field theory; Noether's theorem. Electromagnetism: Poisson and Laplace's equations; Green's theorem; uniqueness of solution in electrostatics; Green's functions; method of images; separation of variables and orthogonal expansions for boundary value problems; multipoles; dielectrics; magnetostatics; time-dependent fields; gauge transformations; time-dependent Green's function; Poynting vector; Maxwell stress tensor; plane electromagnetic waves in media and at dielectric interfaces; frequency dependence of dielectric response; Kramer-Kronig relations; waveguides; radiating systems and diffraction.

**PHYS405 Honours in Physics 48cp**

**Annual** Wollongong On Campus

**Contact Hours:** 10 hours per week

**Pre-requisites:** Completion of a 144 cp BSc degree which includes PHYS305, PHYS325, PHYS335, PHYS375, PHYS385, PHYS390 and PHYS396 (or equivalent). These subjects are to be passed at the level of credit or better.

**Assessment:** The candidate is to complete successfully the following two components: (i) An Honours Project (50% of the assessment) and (ii) A program of coursework (50% of the assessment).

**Subject Description:** Includes: Honours Project, Coursework Program, Electromagnetism, Quantum Mechanics, Astrophysics, Nuclear Physics, Solid State Physics.

**PHYS441 Advanced Astro Physics 4cp**

**Spring** Wollongong On Campus

**Contact Hours:** 6 hours per week

**Pre-requisites:** The main programs in physics at 400-level are directed toward the Honours BSc qualification and BMedPhys. Full time Honours BSc students will normally enrol in PHYS405. Honours BMedPhys students will enrol in the Bachelor of Medical Physics program.

**Assessment:** Two sessional examinations and assignments.

**Subject Description:** This subject consists of the lecture content of Astrophysics and Nuclear Physics sections of PHYS405.

**PHYS444 Quantum Mechanics 8cp**

Annual Wollongong On Campus

**Contact Hours:** 4 hours per week

**Pre-requisites:** The main programs in physics at 400-level are directed toward the Honours BSc qualification and BMedPhys. Full time Honours BSc students will normally enrol in PHYS405. Honours BMedPhys students will enrol in the Bachelor of Medical Physics program.

**Assessment:** Two sessional examinations (45% each) and homework assignments (10%).

**Subject Description:** This subject consists of the lecture content of Quantum Mechanics section of PHYS405.

**PHYS446 Solid State Physics 8cp**

Annual Wollongong On Campus

**Contact Hours:** 4 hours per week

**Pre-requisites:** The main programs in physics at 400-level are directed toward the Honours BSc qualification and BMedPhys. Full time Honours BSc students will normally enrol in PHYS405. Honours BMedPhys students will enrol in the Bachelor of Medical Physics program.

**Assessment:** Two sessional examinations.

**Subject Description:** This subject consists of the lecture content of the Solid State Physics section of PHYS405.

**PHYS451 Nuclear Medicine 8cp**

Annual Wollongong On Campus

**Contact Hours:** 4 hours per week

**Pre-requisites:** 24 cp of third year subjects from the BMedical Physics program including PHYS375 and PHYS255.

**Assessment:** Labs, Assignments, Final Exam.

**Subject Description:** Evolution and basic physics of radionuclide imaging. Tracer principle in Nuclear Medicine. Radioactive agents or diagnostic studies. Therapeutic radioactive agents. Physiology of body organs. Diagnosis of body organ damage - single photon emitters, positron emitters. Technetium generating, instrumentation. Quantification of the radionuclide image. Role of the computer, quality control of Nuclear Medicine studies. Therapeutic Nuclear Medicine, dosimetry principles, waste disposal. I-131, Radiation safety for patients and personnel. Paediatric considerations.

**PHYS452 Medical Imaging 8cp**

Annual Wollongong On Campus

**Contact Hours:** 4 hours per week

**Pre-requisites:** 24 cp of third year subjects from the BMedical Physics program including PHYS375.

**Assessment:** Assignments, test and final written examination 60%; Practical and / or project 40% .

**Subject Description:** Sources of diagnostic X - rays, computer tomography, instrumental set up, image definition, back projection, signal to noise, CT numbers, contrast, CT and radiotherapy. Nuclear magnetic resonances, Larmor frequency, basic imaging, slice selection, phase and frequency encoding, spin echoes, TE and TR relaxation times, mechanisms of contrast in MRI, multiecho imaging, multi slice imaging, fast imaging, flow imaging.

MR angiography, 3D data acquisition, chemical shift imaging, contrast agents, image artifacts and distortion, localised spectroscopy, set up of a clinical MR scanner, safety aspects.

**PHYS453 Radiobiology and Radiation Protection 8cp**

Spring Wollongong On Campus

**Contact Hours:** 4 hours per week

**Pre-requisites:** 24 cp of third year subjects from the BMedical Physics program including PHYS375.

**Assessment:** Assignments, test and written examination 60%; Practical and / or project 40%.

**Subject Description:** Interaction of radiation with matter, molecular effects of radiation, cell kill, repair of injury, assays of cell survival, the effect of oxygen, effect of chemical and biological modifiers, cell kinetics, tumour cell kill, early and late responding normal tissues, radio biological models, four Rs of radiobiology, time as an important factor, clinical impact in radiotherapy, protons, neutrons and pions. The natural background of radiation, man made sources of radiation, genetic and somatic risks, risks of low dose exposure, quality factor, critical organs , concepts of radiation protection.

ALARA limit values, open and closed sources of radiation, incorporation and bio kinetics of radionuclides, external sources of radiation, pregnancy and radiation, the role of the ICRP, legal aspects.

**PHYS456 Imaging Physics 8cp**

Annual Wollongong On Campus

**Contact Hours:** 4 hours per week

**Pre-requisites:** 24 cp in 300-level Physics subjects.

**Assessment:** Image analysis lab 40%, Review paper 30%, End of Session Exam 30%.

**Subject Description:** This course leads to an understanding of the instrumentation and techniques involved imaging and its role in medical physics specifically and in physics generally. The photographic process, solid state detectors and CCD's. Characterisation of detectors; signal to noise, sensitivity, calibration, flat fields and reduction techniques. The hardware and software of image processing; film digitisers and plate scanners. An overview of Medical Imaging Techniques; Radiography, Ultrasonics, NMR.

**PHYS457 Research Project 24cp**

Autumn / Spring Wollongong On Campus

Annual Wollongong On Campus

**Contact Hours:** 8 hours per week

**Pre-requisites:** 24 cp of third year subjects from the BMedical Physics or BSc (Physics).

**Co-requisites:** 24 cp of fourth year subjects from the BMedical Physics or BSc (Honours).

**Assessment:** A formal report on the research project is to be delivered as a colloquium and a written report/thesis to be submitted in tenth week of spring session.

**Subject Description:** The student will be required to participate in a research program on some topic of physics under the supervision of one of the staff member.

The student will have a choice of the following fields: Nuclear Medicine, Medical Imaging, Radiobiology, Radiation Protection, Diagnostic Radiology, Pathology and Imaging Physics, Astronomy, Solid State Physics. All the above research topics may not be available very year.