

ENGINEERING



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INTRODUCTION

The School of Engineering is committed to fostering synergistic relationships between science, engineering, industry and management, which is essential for turning scientific knowledge into commercial products, processes and services.

The School has developed a very strong research base to support its aims of providing students with in-depth knowledge, analytical skills, ideas on innovation, and techniques to translate science into technology in the real world.

Research programmes exist across a wide range of disciplines, supported by the primary research interests of staff. Research areas include:

- » Applied optics and opto-electronics
- » Bioprocess engineering
- » Electronics
- » Engineering
- » Environmental technology
- » Fermentation engineering
- » Food engineering
- » Imaging
- » Materials engineering
- » Mechanical developments and design
- » Mechanical technology
- » Metalics
- » Numerical modeling
- » Physics
- » Power symptoms and control
- » Process engineering
- » Technology innovation.

Students may undertake the following specialisations with the relevant Graduate Diploma:

- » Agriculture and Biosystems – Graduate Diploma in Materials and Processing, and
- » Technology Teaching – Graduate Diploma in Engineering (Technology Teaching).

Collaborative work with industry and research associations are also available.

ACADEMIC STAFF

Associate Professor Brian Gabbitas – Chairperson

BSc, PhD *Leeds*, CEng MIMMM, FIPENZ

Email: briang@waikato.ac.nz

Research interests: Failure of materials; creep and fracture in wood; and powder metallurgical processing of titanium-based alloys.

Professor Janis Swan – Associate Dean (Engineering)

BTech, MTech *Massey*, PhD *Waterloo*, FNZIFST, FIPENZ, MNZM

Email: j.swan@waikato.ac.nz

Research interests: Developing processes to add value to biological products; functional properties of meat used in manufacturing; meat product yield and quality; extracting high-value biochemicals from animal glands; product development of foods for niche markets; bioseparations; and engineering education.

Dr Chi Kit Au

BSc, MSc, PhD *Hong Kong*

Email: ckau@waikato.ac.nz

Research interests: Computation; geometric modeling; and manufacturing technology.

Dr James K Carson

BE(Hons) *Canterbury*, ME *Canterbury*, PhD *Massey*

Email: jkcarson@waikato.ac.nz

Research interests: Measuring and predicting thermo-physical and transport properties; mathematical modelling of thermal processes; refrigeration; food engineering; heat transfer; and thermodynamics in general.

Dr Michael Cree

BSc(Hons), PhD *Canterbury*, SMIEEE, MNZIP, MACPSEM

Email: m.cree@waikato.ac.nz

Research interests: Computer vision; medical physics; retinal imaging; range imaging; and image sensor technology.

Dr Adrian Dorrington

NZCertEng *AUT*, MSc(Tech)(Hons), PhD *Waikato*, MSPIE, MIEEE

Email: adrian@waikato.ac.nz

Research interests: Optoelectronics and optical measurement technologies; 3D imaging for object shape (surface profiling), position, and size measurement; range imaging sensor technology; and optical velocimetry.

Dr Mike Duke

BEng(Hons) *SBankPoly*, PhD *South Bank*, MISES, MANZSES

Email: dukemd@waikato.ac.nz

Research interests: Building integrated photovoltaic thermal systems (BIPVT); high performance battery electric vehicles (BEV), sustainable transport; renewable energy products; vibrations and dynamics.

Associate Professor Ilanko

BSc(Eng)(Hons), MSc *Manc*, PhD *W.Ont*

Email: ilanko@waikato.ac.nz

Research interests: Numerical modelling; vibration and stability of mechanical/structural systems; passive vibration control; adaptive mechanisms; and engineering education.

Nihal Kularatna

BSc(Eng) *Ceyl*, FIET, FIE, SMIEEE

Email: nihalkul@waikato.ac.nz

Research interests: Power conditioning and power protection for electronic systems; DC-DC converters; mixed signal circuits; supercapacitor applications; smart sensor systems; and telecommunications policy and technology developments.

Associate Professor Rainer Künnemeyer

DiplPhys *Hannover*, DrRerNat *Hannover*, SMIEEE, MIPENZ, MSPIE

Email: rainer@waikato.ac.nz

Research interests: Applied optics; optical, non-destructive sensing; spectroscopy; and optoelectronics.

Associate Professor Alan Langdon

BSc, MSc, PhD *Wellington*, FNZIC

Email: a.langdon@waikato.ac.nz

Research interests: Environmental technology; zeolites and mesoporous solids; treatment of water and wastewater; anaerobic digestion and harvesting; and beneficial use of nuisance biomass.

Dr Mark Lay

BSc, MSc, PhD *Waikato*

Email: mclay@waikato.ac.nz

Research interests: Biotechnology and process chromatography; chromatographic modelling; science education research; and cooperative education.

Dr Giridhar Nair

BSc *Kerala*, BSc(Eng) *Cochin*, MTech, PhD IIT *Delhi*

Email: g.nair@waikato.ac.nz

Research interests: Fermentation engineering; modelling and optimising biotechnological processes; biotransformation using enzymes and whole cells; and value addition to agricultural and food processing residues.

Associate Professor Kim Pickering

BSc(Eng)(Hons) *London*, PhD *Surrey*, FIPENZ, IntPENZ, CPEng, MIMMM

Email: klp@waikato.ac.nz

Research interests: Natural and synthetic composite materials; optimising advanced composite properties; and failure mechanisms of composite materials.

ACADEMIC STAFF

Dr Howell Round

BSc(Tech) *Waikato*, MSc *Sur*, PhD *Canterbury*, FNZIP, FACPSEM, SMIEEE, MIPENZ

Email: h.round@waikato.ac.nz

Research interests: Medical physics (breathing control, isotope imaging, radiotherapy dosimetry and treatment planning) and electronics (position and velocity estimation, line scan photography).

Professor Jonathan Scott

BSc, BE, MEngSc, PhD *Sydney*, SMIEEE, MAES, MSPIE

Email: scottj@waikato.ac.nz

Research interests: Analog and digital electronics; microwave and millimetre-wave components; instrumentation and metrology; audio; linearity and distortion; vector correction; III-V and wide-bandgap devices and device models; embedded microcontrollers; electric traction; RF amplifiers; and microwave systems.

Associate Professor Alistair Steyn-Ross

BSc, MSc, PhD *Waikato*, MNZIP, MRSNZ

Email: asr@waikato.ac.nz

Research interests: Cortical modelling; anaesthetics phase-change studies; quantifying brain state; and computational physics.

Professor Moira Steyn-Ross

BSc, MSc, PhD *Waikato*, MNZIP

Email: msr@waikato.ac.nz

Research interests: Cortical modelling; theoretical modelling of bulk electrodynamics of the human brain; EEG simulation; and modelling of sleep, anaesthesia and cognition.

Dr Sadhana Talele

BE, ME *Poona*, GradDipT, PhD *Waikato*, FIETE

Email: sadhana@waikato.ac.nz

Research interests: Mathematical modelling of electroporation and other biophysical phenomenon.

Dr Rob Torrens

BSc(Tech), MSc, PhD *Waikato*

Email: r.torrens@waikato.ac.nz

Research interests: Preparing ceramic powders by chemical methods; processing, consolidation, characterisation and properties of advanced ceramic materials; ceramic oxygen ion conductors; and biomaterials.

Dr Johan Verbeek

BEng, MEng, PhD *Pretoria*, MIPENZ

Email: jverbeek@waikato.ac.nz

Research interests: Using renewable and waste materials to produce polymeric composites; filled and functionally filled polymers; polymer modification and reactive extrusion; biodegradable polymers; and predicting mechanical properties of polymer composites.

Dr Michael Walmsley

BE, PhD *Auckland*, MAICHe

Email: m.walmsley@waikato.ac.nz

Research interests: Fluid mechanics, applied thermodynamics and multiphase separation processes for improving energy efficiency of milk powder plants; and integrated pulp and paper mills.

Dr Marcus Wilson

BA(Hons) *Cambridge*, PhD *Bristol*, MInstP CPhys, MNZIP

Email: m.wilson@waikato.ac.nz

Research interests: Computer and mathematical modelling and analysis of the meso-scale electrical behaviour of the brain. Infra-red physics and signature control (stealth); and using quantum Monte Carlo methods to study electron-electron interactions in solids.

Professor Deliang Zhang

BE *North East Uni Technology*, DPhil *Oxford*, MTMS, MRSNZ

Email: d.zhang@waikato.ac.nz

Research interests: Processing and consolidation of titanium alloy and other metallic, intermetallic and metal-ceramic composite powders; processing, microstructure and mechanical properties of titanium alloys, titanium aluminides, aluminium and magnesium alloys; ultrafine structured and nanostructured metallic materials and nanocomposites; mechanical alloying and high energy mechanical milling; and casting and heat treatment of aluminium and magnesium alloys.

SPECIALISATIONS

Agricultural and Biosystems

This specialisation can be taken with a Graduate Diploma in Materials and Processing.

The Agriculture and Biosystems specialisation provides an agricultural technology, research and design focus for students who have majored in an undergraduate subject in the BSc, BSc(Tech), BCMS or BMS degrees and who have completed any prerequisite papers. It will enhance students attractiveness for careers in agritechology companies and organisations.

Requirements:

120 points, with at least 80 points in Materials and Processing papers chosen from those listed below (coded ENGG or ENMP).

Papers are worth 20 points unless specified.

- » AGRI202B Sustainable Agriculture
- » AGRI301C – Agribusiness in New Zealand
- » ENMP301A/B/S/Y – Special Topics in Technology (Topic in Agritechology)

and 60 points chosen from:

- » ENMP222B – Biotechnology: Food and Bio-Resources
- » ENMP322B – Biotechnology
- » ENMP321B – Engineering Process and Design
- » ENMP381B – Technological Innovation and its Management
- » ENGG381A – Engineering Statistics

Details on ENMP and ENGG Level 200 and Level 300 papers can be found in the **2012 Science & Engineering Undergraduate Handbook** and in the **University Calendar**.

Please refer to the **Waikato Management School Handbook** for details of AGRI202 and AGRI301.

Technology Teaching

This specialisation can be taken with a Graduate Diploma in Engineering and is done in conjunction with a Graduate Diploma in Teaching (Secondary).

Please refer to the **Faculty of Education Handbook** for further details.

PAPERS

Electronics Papers

ENEL501-12A/B/Y (HAM) – Special Topics in Electronics

30 Points

This paper involves directed reading, project work and paper presentation in a defined topic area of electronics.

Convenor(s): Associate Professor Rainer Künnemeyer
 Assessment: Internal assessment/examination ratio: 1 : 0

ENEL502-12A (HAM) – Signal and Image Processing

30 Points

This paper considers the theory and application of digital processing. Emphasis is placed on the z-transform, discrete Fourier transform and the discrete time Fourier transform. Various digital filter design techniques are discussed. Assignments are primarily computer based.

Convenor(s): Dr Howell Round
 Prerequisite(s): (ENGG283 or MATH253) and (ENGG285 or MATH251)
 Assessment: Internal assessment/examination ratio: 1 : 0

ENEL503 – Computational Electromagnetics

This paper will not be offered in 2012.

ENEL504-12B (HAM) – Analog Filter Design

15 Points

This paper introduces the student to the design of electronic filters to process analog signals.

Convenor(s): Professor Jonathan Scott
 Prerequisite(s): ENEL205, ENEL312 and (ENGG285 or MATH251)
 Assessment: Internal assessment/examination ratio: 1 : 1

ENEL505-12A (HAM) – Rechargeable Batteries and their Management

15 Points

This course presents the essential characteristics of rechargeable batteries including techniques and semiconductor components used for managing batteries for optimal run time and cycle life.

Convenor(s): Nihal Kularatna
 Prerequisite(s): ENEL205 and ENEL211
 Assessment: Internal assessment/examination ratio: 1 : 0

PAPERS

ENEL506-12B (HAM) – Surge Protection of Electronic Systems

15 Points

This course presents the fundamentals and techniques for protecting electronic systems against transients and surges, the statistical nature of the surge occurrence, and the international standards applicable.

Convenor(s): Nihal Kularatna
 Prerequisite(s): ENEL205 and ENEL211
 Assessment: Internal assessment/examination ratio: 1 : 0

ENEL517-12A (HAM) – Mechatronics

30 Points

This paper covers embedded micro-programming, feedback control, interface to electro-mechanical systems involving gears, motors, belt drivers, actuators, and sensors: the enabling technologies of robotics. A series of projects require students to integrate software, control, mechanical and electromotive skills to achieve practical goals.

Convenor(s): Professor Jonathan Scott
 Prerequisite(s): ENEL317
 Assessment: Internal assessment/examination ratio: 1 : 0

ENEL522-12B (HAM) – Electro-optical Instrumentation

30 Points

Theoretical and practical aspects of advanced electro-optical instrumentation will be discussed and applied in practical sessions. Topics include telemeters, interferometers for velocity or vibration detection, optical gyroscopes, optical fibre sensors, and others.

Note(s): A minimum mark of 40% is required to receive a passing grade. Laboratories are compulsory.

Convenor(s): Associate Professor Rainer Künnemeyer
 Prerequisite(s): ENEL324
 Restriction(s): ENEL322 and ENEL423
 Required Book(s): Donati **Electro-Optical Instrumentation** (Prentice Hall)
 Assessment: Internal assessment/examination ratio: 1 : 1

ENEL585-12B (HAM) – Power Electronics

30 Points

This paper covers the theory and practice of power semiconductors, power converters, power management, protection, and variable speed drives.

Convenor(s): Nihal Kularatna
 Prerequisite(s): ENEL205 and ENEL211
 Restriction(s): ENEL385 and ENEL485
 Required Book(s): To be advised
 Assessment: Internal assessment/examination ratio: 1 : 1

ENEL590-12C/D (HAM) – Directed Study

30 Points

This paper allows in-depth study and research of a topic specific to electronics.

Assessment: Internal assessment/examination ratio: 1 : 0

Engineering Papers

ENGG501 – System Control Theory

This paper will not be offered in 2012.

ENME540-12A (HAM) – Computer Aided Engineering

30 Points

This paper covers the application of variational principles, approximate methods such as Galerkin's Method to solve partial differential equations, and the Finite Element Analysis (FEA) to solve mechanical engineering problems, with particular emphasis on stress analysis and vibration. Students will be expected to develop their own FEA programmes in MATLAB to solve simple problems and using and use commercial FEA software to solve more complicated practical problems.

<i>Convenor(s):</i>	<i>Associate Professor Ilanko</i>
<i>Equivalent:</i>	<i>ENSC540; ENGG540</i>
<i>Prerequisite(s):</i>	<i>ENGG285 or MATH285, and MATH255, and ENMP313</i>
<i>Restriction(s):</i>	<i>ENGG340, ENSC340, ENGG440, ENGG540 and ENSC440</i>
<i>Assessment:</i>	<i>Internal assessment/examination ratio: 1 : 0</i>

PAPERS

Materials & Processing Papers

ENMP502-12A/C (HAM) – Special Topics in Engineering 1

15 Points

This paper involves directed reading, project work and paper presentation in a defined topic area of technology or engineering.

Convenor(s): *Professor Janis Swan*

Assessment: *Internal assessment/examination ratio: 1 : 0*

ENMP503-12A (HAM) – Special Topics in Engineering 2

15 Points

This paper involves directed reading, project work and paper presentation in a defined topic area of technology or engineering.

Convenor(s): *Professor Janis Swan*

Assessment: *Internal assessment/examination ratio: 1 : 0*

ENMP504-12B/C (HAM) – Special Topics in Engineering 3

15 Points

This paper involves directed reading, project work and paper presentation in a defined topic area of technology or engineering.

Convenor(s): *Professor Janis Swan*

Assessment: *Internal assessment/examination ratio: 1 : 0*

ENMP505-12B (HAM) – Special Topics in Engineering 4

15 Points

This paper involves directed reading, project work and paper presentation in a defined topic area of technology or engineering.

Convenor(s): *Professor Janis Swan*

Assessment: *Internal assessment/examination ratio: 1 : 0*

ENMP513-12A (HAM) – Advanced Material Properties and Performance

15 Points

This paper builds on the materials science and engineering courses taught at undergraduate level and develops the following aspects of materials performance: microstructural/property relationships, fracture mechanics, performance modelling and other aspects of metals, polymers, ceramics and composites.

Convenor(s): *Associate Professor Kim Pickering*

Prerequisite(s): *ENMP211 or equivalent*

Restriction(s): *ENMP511*

Assessment: *Internal assessment/examination ratio: 1 : 4*

ENMP514-12A (HAM) – Advanced Materials Processing*15 Points*

This paper investigates the relationships between processing conditions and microstructure of different materials. Topics include: solidification processing, powder metallurgy, ceramic processing and processing composites. This paper also examines how materials are processed into serviceable products.

Convenor(s): Professor Deliang Zhang
Prerequisite(s): ENMP211 or equivalent
Restriction(s): ENMP411, ENMP512
Assessment: Internal assessment/examination ratio: 1 : 4

ENMP515-12A (HAM) – CAD/CAM for Engineering*15 Points*

This paper will cover the fundamental theories and basic concepts underlying today's technologies in computer-aided design (CAD) and computer-aided manufacturing (CAM). A thorough fundamental theoretical training and mastery of CAD/CAM software will make a student better equipped and more confident to solve difficult problems in design and manufacturing.

Convenor(s): Dr Chi Kit Au
Assessment: Internal assessment/examination ratio: 1 : 4

ENMP516-12B (HAM) – Materials Characterisation*15 Points*

This paper covers the use of advanced analytical techniques used in materials characterisation. These include optical microscopy, x-ray diffraction, transmission electron microscopy, scanning electron microscopy and differential thermal analysis. This paper explains the theory behind these techniques.

Convenor(s): Associate Professor Brian Gabbitas
Prerequisite(s): ENMP211 or equivalent
Assessment: Internal assessment/examination ratio: 1 : 4

ENMP542-12C (HAM) – Design for Energy and the Environment*30 Points*

This interdisciplinary course focuses on the important aspects of science and technology related to new and existing energy resources and energy efficiency. Topics covered reflect the trend of current development in energy technology.

Note(s): *This paper will be taught subject to staff availability.*

Convenor(s): To be advised
Assessment: Internal assessment/examination ratio: 1 : 0

ENMP543-12A (HAM) – Environmental Technology Water and Wastewater 1*15 Points*

This is an inter-disciplinary course covering topics selected from water resources and their management, environmental chemistry, ground water hydrology, water and wastewater engineering, chemical and microbial aspects of water quality, water pollution, remediation, ecotoxicity and ecological engineering. This paper should preferably be taken with ENMP544.

Convenor(s): Associate Professor Alan Langdon
Prerequisite(s): ENMP341 or equivalent
Restriction(s): ENMP541
Assessment: Internal assessment/examination ratio: 1 : 4

PAPERS

ENMP544-12B (HAM) – Environmental Technology Water and Wastewater 2

15 Points

This is an inter-disciplinary course covering topics selected from water resources and their management, environmental chemistry, ground water hydrology, water and wastewater engineering, chemical and microbial aspects of water quality, water pollution, remediation, ecotoxicity and ecological engineering. This paper should preferably be taken with ENMP543.

Convenor(s):	To be advised
Prerequisite(s):	ENMP341 or equivalent
Restriction(s):	ENMP541
Assessment:	Internal assessment/examination ratio: 1 : 4

ENMP561-12A – Bioprocessing 1

15 Points

Theory of protein purification and selected large-scale bioprocesses.

Convenor(s):	Dr Mark Lay
Prerequisite(s):	BIOL251 and either BIOL362 or ENMP322
Restriction(s):	ENMP522
Assessment:	Internal assessment/examination ratio: 1 : 4

ENMP562 – Bioprocessing 2

15 Points

This paper will not be offered in 2012.

ENMP563-12A (HAM) – Food Technology 1

15 Points

This interdisciplinary course is tailored to the food technology interests of the students enrolled. It covers advanced aspects of food science, technology and engineering applications relevant to the food sector in New Zealand and/or selected countries.

Convenor(s):	Dr Giridhar Nair
Restriction(s):	ENMP527
Assessment:	Internal assessment/examination ratio: 1 : 0

ENMP564-12B (HAM) – Food Technology 2

15 Points

This interdisciplinary course is tailored to the food technology interests of the students involved. It covers advanced aspects of food science, technology and engineering applications relevant to the food sector in New Zealand and/or selected countries.

Convenor(s):	Professor Janis Swan
Prerequisite(s):	Level 300 process engineering or biological science
Restriction(s):	ENMP527
Assessment:	Internal assessment/examination ratio: 1 : 0

ENMP568-12B (HAM) – Engineering Applied Practice 1*15 Points*

An intensive practical training with some aspect of engineering or technology.

*Convenor(s): Dr Mark Lay and Dr Rob Torrens**Assessment: Internal assessment/examination ratio: 1 : 0***ENMP569-12A (HAM) – Engineering Applied Practice 2***15 Points*

An intensive practical training with some aspect of engineering or technology.

*Convenor(s): Dr Mark Lay and Dr Rob Torrens**Assessment: Internal assessment/examination ratio: 1 : 0***ENMP585-12A (HAM) – Industrial Technology and Innovation 1***15 Points*

An interdisciplinary course designed for MSc and MSc(Tech) students to develop their ability to use scientific, management and personal skills to plan and implement programmes that maximise competitive advantage in industry through technological innovation, entrepreneurship and application or new knowledge generated by research. Case studies, readings, individual and group presentations form an important part of this course. This paper should preferably be taken with ENMP586.

*Prerequisite(s): ENMP381 or equivalent**Restriction(s): ENMP581**Convenor(s): Associate Professor Alan Langdon**Assessment: Internal assessment/examination ratio: 1 : 0***ENMP586-12B (HAM) – Industrial Technology and Innovation 2***15 Points*

An interdisciplinary course designed for MSc and MSc(Tech) students to develop their ability to use scientific, management and personal skills to plan and implement programmes that maximise competitive advantage in industry through technological innovation, entrepreneurship and application or new knowledge generated by research. Case studies, readings, individual and group presentations form an important part of this course.

*Prerequisite(s): ENMP381 or equivalent**Restriction(s): ENMP581**Convenor(s): TBA**Assessment: Internal assessment/examination ratio: 1 : 0***ENMP590-12C/D (HAM) – Directed Study***30 Points*

This paper allows in depth study and research of a specific technological or engineering topic.

*Convenor(s): Professor Janis Swan**Assessment: Internal assessment/examination ratio: 1 : 0*

PAPERS

Physics Papers

PHYS506-12A (HAM) – Advanced Quantum Theory

30 Points

This paper covers the foundations of quantum mechanics and develops advanced applications.

Convenor(s): *Dr Michael Cree*

Assessment: *Internal assessment/examination ratio: 1 : 0*

PHYS509-12B (HAM) – Medical Physics

30 Points

This paper reviews the application of physics in many areas of medicine. It does not require a background in anatomy or biology. Areas studied include cardiology, respiratory medicine, radiotherapy, medical imaging, etc.

Prerequisite(s): *MATH253, MATH255, PHYS201, PHYS202, and PHYS204*

Convenor(s): *Dr Howell Round*

Restriction(s): *PHYS301*

Assessment: *Internal assessment/examination ratio: 2 : 3*

PHYS511 – Particles and Fields

This paper will not be offered in 2012.

PHYS516-12A (HAM) – Computational Biophysics

30 Points

This is a lecture and computer-laboratory course on the computational methods used in neuroscience and biophysics. Topics covered include linear and non-linear differential equations, Euler and Runge-Kutta integration methods, limit cycles, action potential generation, hysteresis and memory in simple neural systems, stability and stochastic resonance, random numbers and noise simulation, root finding, curve fitting, and Fourier analysis. The programming language used is MATLAB.

Convenor(s): *Associate Professor Alistair Steyn-Ross*

Prerequisite(s): *Any one of PHYS201, PHYS202, ENEL284 or ENEL285; and any two of MATH251, MATH253, MATH255, ENGG283, ENGG284, ENGG285, ENGG287*

Restriction(s): *PHYS315*

Assessment: *Internal assessment/examination ratio: 1 : 0*

PHYS551 – Methods in Theoretical Physics 1

This paper will not be offered in 2012.

PHYS552-12B (HAM) – Methods in Theoretical Physics 2*15 Points*

This paper introduces geometric methods applied to physics. It covers simple application of group theory to simplify problems with symmetry, and an introduction to geometric algebra.

Note(s): *This paper will only be offered if there is sufficient student interest.*

Convenor(s): *Dr Marcus Wilson*
 Prerequisite(s): *MATH253 and one of MATH251, MATH252, MATH255*
 Assessment: *Internal assessment/examination ratio: 1 : 1*

PHYS560-12A/B/Y (HAM) – Special Topics in Physics 1*15 Points*

This paper involves directed reading, project work and paper presentation in a defined topic area of physics.

Convenor(s): *Professor Moira Steyn-Ross*
 Prerequisite(s): *Topic dependent*
 Assessment: *Internal assessment/examination ratio: 1 : 1*

PHYS561-12A/B/Y (HAM) – Special Topics in Physics 2*15 Points*

This paper involves directed reading, project work and paper presentation in a defined topic area of physics.

Convenor(s): *Professor Moira Steyn-Ross*
 Prerequisite(s): *Topic dependent*
 Assessment: *Internal assessment/examination ratio: 1 : 1*

PHYS590-12A/B/Y (HAM) – Directed Study*30 Points*

Convenor(s): *Professor Janis Swan*
 Assessment: *Internal assessment/examination ratio: 1 : 0*

Papers for the ME Degree

Up to 30 points of the ME can be taught papers. Please refer to the following subjects:

- » Computer Science page 64
- » Electronics page 55
- » Engineering page 57
- » Materials & Processing page 58
- » Mathematics page 64
- » Physics page 62

Candidates may be permitted to replace a maximum of 30 points with papers at 500 Level from other subjects.

PAPERS

Computer Science

For details of the following papers please refer to the *Computing & Mathematical Sciences Handbook* or the *University Calendar*.

Papers are worth 15 points unless specified.

- » COMP501-12B – Topics in Operating Systems
- » COMP513-12A – Computer Networks
- » COMP514-12B – Advanced Communications
- » COMP521-12A – Machine Learning Algorithms
- » COMP535 – Image Analysis and Classification[†]
- » COMP536-12B – Advanced Graphics and Computer Games
- » COMP537-12B – User Interfaces for Information Retrieval
- » COMP538 – Topics in Human-Computer Interaction[†]
- » COMP539-12B – Usability Engineering
- » COMP542-12A – Web Search: Technical and Social Issues
- » COMP543-12B – Knowledge and Information Management
- » COMP552-12A – Model Checking
- » COMP553-12A – Extremely Parallel Programming
- » COMP554-12B – Specification Languages and Models
- » COMP555-12A – Bioinformatics
- » COMP560-12A/C – Turing Topics in Computer Science
- » COMP561-12A/C – Von Neumann Topics in Computer Science (30 points)
- » COMP562-12A/C – Grace Hopper Topics in Computer Science

[†]*Not offered in 2012.*

Mathematics

For details of these papers please refer to the *Computing & Mathematical Sciences Handbook* or the *University Calendar*.

- » MATH501-12B – Metric Spaces
- » MATH505 – Topics in Analysis and Topology[†]
- » MATH509 – Number Theory[†]
- » MATH511-12A – Advanced Algebra
- » MATH512 – Continuous Groups[†]
- » MATH513-12A – Finite Groups
- » MATH515-12B – Topics in Number Theory
- » MATH516-12B – Topics in Discrete Mathematics
- » MATH541-12A – Partial Differential Equations 1
- » MATH542-12B – Partial Differential Equations 2
- » MATH581-12A/B – Special Topic in Mathematics 1
- » MATH582-12A/B – Special Topic in Mathematics 2

[†]*Not offered in 2012.*

Theses for ME

POINTS	CODE	TITLE
90	ENGG593-12C (HAM)	Engineering Thesis
120	ENGG594-12C (HAM)	Engineering Thesis

Dissertations and Theses for MSc and MSc(Tech)

POINTS	CODE	TITLE
30	ENEL591-12C (HAM)	Dissertation
60	ENEL592-12C (HAM)	Dissertation
90	ENEL593-12C (HAM)	Electronics Thesis (3 papers)
120	ENEL594-12C (HAM)	Electronics Thesis (4 papers)
150	ENEL595-12C (HAM)	Electronics Thesis (5 papers)
30	ENMP591-12C (HAM)	Dissertation
60	ENMP592-12C (HAM)	Dissertation
90	ENMP593-12C (HAM)	Materials and Processing Thesis
120	ENMP594-12C (HAM)	Materials and Processing Thesis
150	ENMP595-12C (HAM)	Materials and Processing Thesis
30	PHYS591-12C (HAM)	Dissertation (1 paper)
60	PHYS592-12C (HAM)	Dissertation (2 papers)
90	PHYS593-12C (HAM)	Physics Thesis (3 papers)
120	PHYS594-12C (HAM)	Physics Thesis (4 papers)