

ELECTRONICS

www.sci.waikato.ac.nz/study/subjects/electronics

Electronics is the science and technology concerned with the controlled flow of electrons and other carriers of electric charge. Papers cover theory, design, and construction of electronic devices, circuits, instruments, or systems.

CONTACTS FOR ELECTRONICS

Electronics is administered by the School of Engineering.

School Administrators Mary Dalbeth / Janine Williams	Room: EG.04 Phone: 07 838 4266 / 07 838 4026 Email: engineering@waikato.ac.nz
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Associate Professor Rainer Künнемeyer	Room: CD1.02 Phone: 07 838 4630 Email: rainer@waikato.ac.nz
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Degrees

Electronics is a major subject for the Bachelor of Science or Bachelor of Science (Technology) degrees. Papers in electronics are available at all levels of study from undergraduate degrees through to postgraduate and doctoral studies.

Students interested in the Bachelor of Engineering degree should refer to the Electronic Engineering programme (page 91).

Electronics Major

General Structure of an Electronics Major for the BSc and BSc(Tech) degrees

100 LEVEL	ENEL111 15 points	100 Level – Prerequisites: ENEL111 Introduction to Electronics. Recommended: PHYS103 Physics for Scientists and Engineers, COMP103 Introduction to Computer Science 1.		
200 LEVEL	ENEL205 20 points	ENEL211 20 points	ENEL2XX 20 points	200 Level – 40-60 points at Level 200. Compulsory: ENEL205 Analog Electronics and Circuit Analysis, ENEL211 Digital Electronics. Optional: ENEL284 Engineering Physics 1, ENEL285 Engineering Physics 2.
300 LEVEL	* 20 points	* 20 points	* 20 points	300 Level – 60-80 points at Level 300 Electronics.

Specialisations

Students may undertake the following specialisations for the BSc and BSc(Tech) major in Electronics.

» Agribusiness	*
» Science International	page 157
» Te Pūtaiao me ngā take Māori	page 162

**Enrolment in this specialisation should be completed in consultation with both the Faculty of Science & Engineering and the Waikato Management School.*

Choosing Papers

Electronics Major

To complete a major in Electronics, students must complete 120 points above 100 Level, including at least 60 points above 200 Level in electronics papers.

100 Level – Papers are worth 15 points.

The following papers are recommended to fulfil prerequisites for 200 and 300 Level papers:

Prerequisites

- » ENEL111A – Introduction to Electronics

To fulfil prerequisites for other 200 and 300 Level electronics papers, it is highly recommended to also enrol in:

- » PHYS103
- » MATH101
- » MATH102
- » COMP103

Please take care when choosing 100 Level papers as many are required as prerequisites for 200 and 300 Level papers. Failure to complete prerequisites will limit your paper choices.

200 Level – Papers are worth 20 points unless specified.

Choose a further 40 to 60 points at 200 Level Electronics from the following papers:

Compulsory papers

- » ENEL205B – Analog Electronics and Circuit Analysis
- » ENEL211A – Digital Electronics

Optional papers

- » ENEL284B – Electricity and Magnetism (10 points)
- » ENEL285A – Quantum and Solid State Physics (10 points)

300 Level – Papers are worth 20 points unless specified.

Choose a further 60 to 80 points from 300 Level electronics papers to give a total of 120 points at Level 200 and above:

*Choose from:

- » COMP311B – Computer Systems Architecture
- » ENEL301A/B/C/Y – Special Topics in Electronics
- » ENEL312A – Electromagnetic Waves
- » ENEL317B – Microprocessor Applications and Control
- » ENEL321B – Application Specific Integrated Circuits
- » ENEL324A – Optoelectronics
- » ENEL382B – High Speed Communications
- » ENEL385B – Power Electronics
- » ENME340A – Computer Aided Engineering

Timetable Clashes

Your selection of papers may depend on your timetable. You will not usually be permitted to take papers which have lecture clashes. Laboratory clashes can usually be resolved. You should contact the relevant department if you have a laboratory clash.

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Electronics Papers

100 Level Papers

ENEL111-12A (HAM) – Introduction to Electronics

15 Points

This paper covers basic electronic concepts. Topics covered include circuit theory, passive components, simple active devices, amplifiers and feedback, Boolean logic circuits, digital-to-analog and analog-to-digital conversion.

This paper is recommended for all Physics majors.

Co-ordinator(s): Professor Jonathan Scott

Prerequisite(s): 14 credits at Level 3 in NCEA Physics, Mathematics with Calculus or Statistics and Modelling; or a Bursary mark of 50% or better in Physics, Mathematics with Calculus or Statistics and Modelling

Corequisite(s): Students who intend to continue in Physics or Electronics are also recommended to enrol in MATH101

Required book(s): To be advised

Assessment: Internal assessment/examination ratio: 1 : 1

200 Level Papers

ENEL205-12B (HAM) – Analog Electronics and Circuit Analysis

20 Points

This paper covers design and analysis of analog electronic circuits. Topics include ac circuit analysis, nodal analysis, Laplace Transforms, BJT amplifier circuits and their equivalent circuits, frequency response. Feedback, output stages, oscillators, operational amplifiers and their limitations, active filters, using PSPICE. This paper includes a laboratory component.

Co-ordinator(s): Dr Sadhana Talele

Prerequisite(s): ENEL111

Required Book(s): Neamen *Microelectronics, Circuit Analyses and Design* 3rd ed (McGraw Hill) 2007

Assessment: Internal assessment/examination ratio: 1 : 1

ENEL211-12A (HAM) – Digital Electronics

20 Points

This paper covers the theory, design and applications of logic circuits, and the technology developments related to digital systems including an introduction to microprocessors, memories and programmable logic. This paper is taught jointly by Engineering and Computer Science. It consists of both lectures and laboratory work.

Co-ordinator(s): Dr Michael Cree

Prerequisite(s): ENEL111. Candidates are advised also to take ENEL205 if they are planning to take 300 Level papers in electronics.

Assessment: Internal assessment/examination ratio: 1 : 1

ENEL284-12B (HAM) – Electricity and Magnetism

10 Points

This paper teaches principles of electromagnetism relevant to engineering. It covers fundamental theory of electric and magnetic fields.

Co-ordinator(s): Professor Moira Steyn-Ross

Prerequisite(s): PHYS103 and ENEL111

Corequisite(s): either ENGG285 or MATH251, and either ENGG283 or MATH253, and either ENGG284 or MATH255

Restriction(s): ENEL281, PHYS201 and PHYS304

Assessment: Internal assessment/examination ratio: 1 : 2

ENEL285-12A (HAM) – Quantum and Solid State Physics*10 Points*

This paper teaches principles of modern physics relevant to engineering. It covers introductory quantum mechanics, atomic and semiconductor physics.

Co-ordinator(s): Dr Michael Cree
Prerequisite(s): PHYS103
Restriction(s): ENEL281, PHYS202 and PHYS304
Recommended book(s): Krane **Modern Physics 2nd ed** (Wiley) 1996
Assessment: Internal assessment/examination ratio: 1 : 2

300 Level Papers**COMP311-12B (HAM) – Computer Systems Architecture***20 Points*

For details refer to the **Computing & Mathematical Sciences Handbook**, or the **University Calendar**.

ENEL301-12A/B/C/Y (HAM) – Special Topics in Electronics*20 Points*

An independent theoretical, literature, or experimental investigation of an electronics topic, supervised by a member of staff. Progress and assessment are negotiated between the student and supervisor, and typically take the form of a poster, paper manuscript and/or report.

Note(s): Admission is at the discretion of the chair of department.
Co-ordinator(s): Associate Professor Rainer Künnemeyer
Assessment: Internal assessment/examination ratio: 1 : 0

ENEL312-12A (HAM) – Electromagnetic Waves*20 Points*

This paper discusses electromagnetic wave phenomena using classical electromagnetic theory, which is applied to a range of engineering applications such as transmission lines, waveguides, antennas, electromagnetic interference, and microwave circuits.

Note(s): A minimum mark of 40% is required in the examination to receive a passing grade. Laboratory attendance is compulsory.

Co-ordinator(s): Associate Professor Rainer Künnemeyer
Prerequisite(s): ENEL284 or PHYS201, and ENGG285 or MATH251
Restriction(s): ENEL301-09A
Equivalent: PHYS312
Required book(s): Wentworth **Fundamentals of Electromagnetics with Engineering Applications** (Wiley) 2005
Assessment: Internal assessment/examination ratio: 1 : 2

ENEL317-12B (HAM) – Microprocessor Applications and Control*20 Points*

This paper provides an introduction to the field of mechatronics. Topics covered include a study of sensors and transducers, signal conditioning electronics, circuit analysis using both the Laplace and Z transforms, and control theory (both PID and Fuzzy). Laboratory exercises in which microprocessors are interfaced to physical systems in order to monitor and/or control real-world processes. This paper includes a compulsory laboratory component. A minimum mark of 40% in the internal tests is normally required in order to receive a passing grade.

Co-ordinator(s): Dr Howell Round
Prerequisite(s): ENEL205, ENEL211 and COMP103
Assessment: Internal assessment/examination ratio: 1 : 0

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ENEL321-12B (HAM) – Application Specific Integrated Circuits

20 Points

This paper considers the design and construction of application-specific integrated circuits with emphasis on VLSI. Topics include silicon and compound semiconductor IC fabrication, design hierarchy, layout, reliability, and testing.

Co-ordinator(s): Professor Jonathan Scott

Prerequisite(s): ENEL205 and ENEL211

Recommended book(s): Weste and Harris *CMOS VLSI Design* (Addison-Wesley) 2005; Grey and Meyer, *Analysis and Design of Analog Integrated Circuits*

Assessment: Internal assessment/examination ratio: 1 : 1

ENEL324-12A (HAM) – Optoelectronics

20 Points

This paper discusses the principles of modern optoelectronic components and systems in particular lasers, semi-conductor devices, optoelectronic devices and optical fibres. Theoretical as well as practical aspects will be covered.

Note(s): Laboratory attendance is compulsory. A minimum mark of 40% is required in the examination to receive a passing grade.

Co-ordinator(s): Associate Professor Rainer Künemeyer

Prerequisite(s): MATH101, MATH102 and either ENEL285 or PHYS202

Required book(s): Kasap *Optoelectronics and Photonics* (Prentice-Hall) 2001

Assessment: Internal assessment/examination ratio: 1 : 2

ENEL382-12B (HAM) – High Speed Communications

20 Points

This lecture and laboratory paper introduces communications theory and its application to wireless and fibre-optic communication systems.

Co-ordinator(s): Dr Adrian Dorrington

Prerequisite(s): ENGG283 and ENGG285, plus either ENEL205 or ENEL211

Corequisite(s): ENEL324

Assessment: Internal assessment/examination ratio: 1 : 1

ENEL385-12B (HAM) – Power Electronics

20 Points

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

Note(s): A minimum mark of 40% is required in the examination to receive a passing grade.

Co-ordinator(s): Nihal Kularatna

Prerequisite(s): ENEL205 and ENEL211

Required book(s): M. Brown, ed. *Power Sources and Supplies* (Newnes); Kularatna *Electronic Circuit Design: From Concept to Implementation* (CRC Press) 2008

Assessment: Internal assessment/examination ratio: 1 : 1

400 Level Papers

ENEL402-12A (HAM) – Signal and Image Processing

20 Points

This paper deals with discrete time systems, z-transform, discrete fourier transform, digital filtering and image processing. It is highly computer based.

Co-ordinator(s): Dr Howell Round

Prerequisites(s): MATH251 and MATH253, or ENGG283 and ENGG285

Restrictions: ENEL502

Required Book(s): Ingle and Proakis *Digital Signal Processing using MATLAB* (Brooks/Cole) 2000

Assessment: Internal assessment/examination ratio: 1:0

ENEL417-12A (HAM) – Mechatronics*20 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.

<i>Co-ordinator(s):</i>	<i>Professor Jonathan Scott</i>
<i>Prerequisite(s):</i>	<i>ENEL317</i>
<i>Restriction(s):</i>	<i>ENEL517</i>
<i>Assessment:</i>	<i>Internal assessment/examination ratio: 1 : 0</i>

ENEL423-12B (HAM) – Electro-optical Instrumentation*20 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% in the examination is required to receive a passing grade. Laboratories are compulsory.*

<i>Co-ordinator(s):</i>	<i>Associate Professor Rainer Künnemeyer</i>
<i>Prerequisite(s):</i>	<i>ENEL324</i>
<i>Restriction(s):</i>	<i>ENEL322 and ENEL522</i>
<i>Required book(s):</i>	<i>To be advised</i>
<i>Assessment:</i>	<i>Internal assessment/examination ratio: 1 : 1</i>

ENEL485-12B (HAM) – Power Electronics*20 Points*

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

Note(s): *A minimum mark of 40% in the examination is required to receive a passing grade.*

<i>Co-ordinator(s):</i>	<i>Nihal Kularatna</i>
<i>Prerequisite(s):</i>	<i>ENEL205 and ENEL211</i>
<i>Restriction(s):</i>	<i>ENEL385</i>
<i>Required book(s):</i>	<i>Brown, ed. Power Sources and Supplies (Newnes); Kularatna Power Electronics Design Handbook – Low Power Components and Applications (Newnes) 1998</i>
<i>Assessment:</i>	<i>Internal assessment/examination ratio: 1 : 1</i>

ENGG401 – Systems Control Theory*This paper will not be offered in 2012.***ENME440-12A (HAM) – Computer Aided Engineering***20 Points*

For details refer to Materials and Processing ENME440.

BSc(Tech) Work Placement Papers

For details refer to Work Placements.