XMUT204 Electronic Design

Course Outline 2025

Prescription

This course is a practically oriented introduction to fundamental electronic devices and their circuit applications. Topics include semiconductor fundamentals, diodes, transistors and operational amplifiers.

Course learning objectives

Students who pass this course should be able to:

1. Use a range of electronic measuring instruments (BE graduate attribute 3(a)).
2. Understand the basic characteristics of semiconductor materials and how these properties are utilised in the design of diodes and transistors (BE graduate attributes 3(a) & 3(b)).
3. Describe the functions and current-voltage characteristics of diodes and transistors and calculate circuit characteristics and behaviour employing these devices (BE graduate attributes 3(a) & 3(b)).
4. Design, prototype and test basic circuits that contain active devices (BE graduate attributes 3(a) & 3(b)).
5. Maintain a detailed laboratory logbook and use this log to write design reports detailing the design process.

Course content

The course is a practically oriented introduction to electronic devices and their circuit applications. Topics include semiconductor fundamentals, diodes and transistors, while basic circuit design, construction and testing will be introduced.

The course builds on the basic electrical theory from ENGR 142/PHYS 115 and is a required course for Electronic and Computer Engineering (ECEN) students in the Bachelor of Engineering (Honours) - BE(Hons) and an elective course for the Bachelor of Science - BSc majors in both Physics and Applied Physics as well as Electronics and Computer Systems.

XMUT204 Electronic Design is a prerequisite for the third year engineering course XMUT303 Analogue Electronics.

Required Academic Background

A basic background in electronic circuits and their analysis as well as the properties of passive components (resistors, capacitors and inductors)

Lecturers

The lecturers for this course are:

Jimmi Rosa

jimmi.rosa@ecs.vuw.ac.nz

Huang Junqi

huangjunqi@t.xmut.edu.cn

Yau Hee Kho

yauhee.kho@vuw.ac.nz

Teaching Format

During the semester, there will be two 1.5 hours lecture per week. There are also two 2 hours laboratory that will start in Week 2.

Dates (semester, teaching & break dates)

In 2025, there are a total of 16 weeks of teaching and learning period spanning from Week 1 (17th February 2024) until Week 16 (6th June 2024). The detail of weekly schedule is given below.

Activities	**Timetable**	**Venue**	**Student Cohort**	
Lecture	Monday, 8:20 – 9:55 Wednesday, 8:20 – 9:55	Mingli 1-204 Mingli, 8-309	Group 1 & 2	
Laboratory	TBA (see co-teacher for the details)	TBA	Group 1	
	TBA (see co-teacher for the details)	TBA	Group 2	

Laboratories will be based on practical exercises in the electronic lab. Lab manuals, questions for the lab reports and related files are posted in the wiki website of the course. The tasks carried out in the labs will be also supplemented with electronic circuit simulations using the recommended LTspice software (installation file of this open source software is available in the wiki website).

Set Texts and Recommended Readings

Required

The recommended textbook for the course is: Electronic Devices (Conventional Current version) by Thomas L. Floyd. The 9th edition should be available in the bookshop. Other edition is also good.

It can also be purchased as an eText book from Pearson – see further the publisher website: http://www.pearsoned.co.nz/9781292038070

It is highly recommended that you obtain a copy of this text as the course is well aligned with this textbook. Parts of this book are also useful for learning in XMUT203 and XMUT303.

Recommended

Other books that may be of interest:

- Electronic Devices and Circuit Theory by Boylestad and Nashelsky – similar to Floyd.
- The Art of Electronics by Horowitz and Hill – a classic guide to electronics but not light reading!
- Electronics Fundamentals by Floyd and Buchla - a bit low level.
- Practical Electronics for Inventors (Third Edition) – Paul Sherz and Simon Monk.

A wide variety of material is also available on the web. A good example is the "Lessons in Electric Circuits" at http://www.allaboutcircuits.com which covers a wide variety of electronic topics.

See the appendix for a table that outlines the mapping between the topics in the course and the relevant chapters in the recommended textbook.

Mandatory Course Requirements

In addition to achieving an overall pass mark of at least 60% (in XMUT scale), students should:

- Satisfactorily complete at least four of the five laboratories as well as both design projects; meaning you have completed the laboratory and have made a reasonable attempt to complete and hand in the laboratory report.
- Achieve a mark of at least 40% in the final examination.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

This course will be assessed through assignments, laboratories, design work projects, mid-term test and a final examination.

Assessment	**Schedule**	**Learning Outcome**	**Weight**
Assignments (4)	Fortnightly	CLO: 1, 2, & 3	10%
Laboratory Reports (2 of 5)	Fortnightly	CLO: 4 & 5	10%
Design Projects (2)	Week 8 & 15	CLO: 1, 2, 3, 4 and 5	20%
Mid-term Test	Week 8	CLO: 1, 2 & 3	10%
Final Exam	Week 17-18	CLO: 1, 2 & 3	40%
Attendance	All weeks		10%

Extensions

All work is due in on the due date and individual extensions will only be granted in exceptional personal circumstances, and should be negotiated in writing with the course lecturer before the deadline whenever possible. Documentation (e.g. medical certificate, official request letter, etc.) may be required.

Submission & Return

The assignment web page of the wiki website of the course will be used for submitting both laboratories reports and assignments. Marked and commented materials will be provided in the relevant feedback section in the assignment web page.

Workload

The total workload for the course is 150 hours. In order to maintain satisfactory progress, you should plan to spend an average of 10 hours per week on this course. A plausible and approximate breakdown for these weekly hours would be:

- Lectures and tutorials: 8 hours.
- Laboratory work and write up: 6 hours.
- Assignments and self-study: 4-6 hours.

Additional time will be required for exam preparation and for completion of the design exercises.

Teaching Topics

The planned content of the course is as follows:

- *Semiconductor Properties*: basic properties of intrinsic and extrinsic semiconductors and semiconductor microfabrication.
- *Diodes*: p-n junctions, biasing, diode characteristic, diode models, rectification and diode applications, light emitting diodes and other diodes.
- *Bipolar Junction Transistors (BJTs)*: structure and operation, current gain, trans-conductance, input, transfer and output characteristics, BJT as an amplifier - inverting amplifier, dc biasing, small signal approximations, different transistor configurations, Class A amplifier design.
- *Field Effect Transistors (FETs)*: structure and operation, input, transfer and output characteristics, dc circuits, FETs as logic gates and amplifiers.

Teaching Plan

See also course schedule for details of submission and dates.

Week	Lecture	Tutorial	Laboratory	Assessment
1	Introduction to Semiconductors		Lab 1	
2	Diode and PN Junctions	Tutorial 1	Demo 1	
3	Diode Models and Circuit Analysis		Demo 2	Assignment 1
4	Diode Applications	Tutorial 2	Lab 2	
5	Diode Applications		Demo 3	Lab Report 2
6	Special Purpose Diodes (Zener Diode)	Tutorial 3	Lab 3	
7	Special Purpose Diodes (LEDs)		Demo 4	Assignment 2
8	Special Purpose Diodes (Solar Cells I)	Mid-term Test	Design Project 1	Mid-term Test
9	Introduction to Transistors		Design Project 1	Design Project Report 1
10	BJT Biasing Circuits	Tutorial 4	Lab 4	
11	BJT Switches		Demo 5	
12	BJT Amplifiers	Tutorial 5	Lab 5	Assignment 3
13	BJT AC Analysis		Demo 6	Lab Report 5
14	BJT Amplifiers Design	Tutorial 6	Demo 7	
15	BJT Further Circuits		Design Project 2	Assignment 4
16	FET Introduction and Characteristics	Preparing for Final Exam	Design Project 2	Design Project Report 2
17-18				Final Exam

Communication of Additional Information

- This course uses XMUT204 wiki website of the School of Engineering and Computer Science in the Victoria University of Wellington and the XMUT204 course WeChat group. Students should check the website for course materials and other information regularly.

  https://ecs.victoria.ac.nz/Courses/XMUT204_2025T1/WebHome

- Please ensure that the email address and WeChat account you have provided for university administration are correct in order to receive notifications from staff.

Links to General Course Information

- Academic Integrity and Plagiarism: https://www.victoria.ac.nz/students/study/exams/integrity-plagiarism.
- Academic Progress: https://www.victoria.ac.nz/students/study/progress/academic-progess (including restrictions and non-engagement).

Appendix

Lecture	Lecture Topic	Tutorial	Book Chapter	Page
1	Introduction to Semiconductors		Chapter 1 – Introduction to Electronics	1-23
2	Diode and PN Junctions	Tutorial 1	Chapter 2 – Diodes and Applications	30-75
3	Diode Models		Chapter 2 – Diodes and Applications	30-75
4	Diode Applications (Rectifiers)	Tutorial 2	Chapter 2 – Diodes and Applications	30-75
5	Diode Applications (Regulators)		Chapter 2 – Diodes and Applications	30-75
6	Special Purpose Diodes (LEDs)	Tutorial 3	Chapter 3 – Special Purpose Diodes	112-152
7	Special Purpose Diodes (Solar Cells)		Chapter 3 – Special Purpose Diodes	112-152
8	Special Purpose Diodes (Solar Cells II)		Chapter 3 – Special Purpose Diodes	112-152
9	Introduction to Transistors		Chapter 4 – Bipolar Junction Transistors	173-207
10	BJT Biasing Circuits	Tutorial 4	Chapter 5 – Transistor Bias Circuits	228-251
11	BJT Switches		Chapter 4 – Bipolar Junction Transistors	173-207
12	BJT Amplifiers	Tutorial 5	Chapter 6 – BJT Amplifiers	271-313
13	BJT AC Analysis		Chapter 6 – BJT Amplifiers	271-313
14	BJT Amplifiers Design	Tutorial 6	Chapter 6 – BJT Amplifiers	271-313
			Chapter 10 – Amplifier Frequency Response	505-548
15	BJT Further Circuits		Chapter 5 – Transistor Bias Circuits	228-251
			Chapter 6 – BJT Amplifiers	271-313
16	FET Introduction and Characteristics		Chapter 8 – Field Effect Transistors (FETs)	384-426