XMUT303 Analogue Electronics

Course Overview Semester 1 2026

This document sets out the workload and assessment requirements for XMUT303. It also provides contact information for staff involved in the course. If the contents of this document are altered during the course, you will be advised of the change by an announcement in lectures and/or on the course website.

Objectives

The prime purpose of the course is to teach students to analyse and design analogue circuits for use in scientific instrumentation, data acquisition, and communications. A considerable emphasis is placed on design skills.

Learning Outcomes

This course contributes to the graduate attributes of the Bachelor of Engineering (BE) of Victoria University of Wellington as indicated below.

By the end of the course, students should be able to:

1. Analyse the operation of a range of analogue circuits including amplifiers, filters, oscillators and power supplies (BE graduate attribute 3(b)).
2. Design standard analogue electronic circuits with regard to practical considerations, such as component imperfections and thermal management (BE graduate attributes 3(b), 3(e)).
3. Design and demonstrate the operation of a complex analogue system (BE graduate attributes 3(b), 3(d), 3(f)).
4. Use modern test equipment and design tools in the design and testing of electronic systems (BE graduate attributes 3(b), 3(f)).

Particular topics covered in the course include:

Operational Amplifiers Circuits, Operational Amplifier Analysis, Operational Amplifier Internals, Stability in Operational Amplifier Circuits, Comparators, Oscillators, Analogue Filters, Power Amplifiers, Power Supplies, Thermal Analysis, Noise Analysis and Printed Circuit Board.

Teaching Staff

The lecturer and co-teacher for the course and their contact details are:

- Jimmi Rosa, VUW Kelburn Campus, Cotton Building, Room CO252, phone: +64 04 463 6031, and email: jimmi.rosa@ecs.vuw.ac.nz
- Xu Jinghong, XMUT Campus, Jinggong Building, Room 3-412, and email: 2015000089@xmut.edu.cn

Teaching Assistant, Laboratory Demonstrator and Tutorial Assistant: T.B.C.

Lectures, Tutorials and Laboratories

Classes for the course are held tentatively in a compressed schedule (8 weeks in total) from Week 9 to Week 14 at the following times:

Activities	Timetable	Venue
Lectures/ Tutorials	Monday, 10:15-11:45 Tuesday, 18:30-20:55 Wednesday, 18:30-20:55	Mingli 8-309 Mingli 2-204 Mingli 2-204
Laboratories	TBA	TBA

The lectures, tutorials and labs are scheduled as follows:

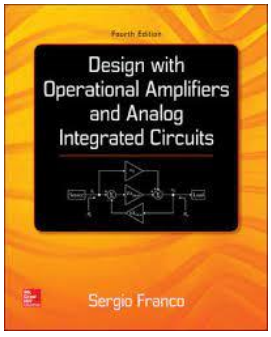
Week	Lecture	Tutorial	Laboratory	Assessment
9	Lecture 1: Introduction to Course and Analogue Electronics		Lab 1: Op Amp Circuits 1	
	Lecture 2: Introduction to Operational Amplifiers	Tutorial 1: Intro to Op Amp	Demo 1a	
10	Lecture 3: Internal Op Amp Characteristics		Demo 1b	
	Lecture 4: Static Limitation	Tutorial 2: Op Amp Design and Analysis	Demo 1c	Lab Report 1 Assignment 1
11	Lecture 5: Dynamic Limitation		Lab 2: Op Amp Circuits 2	
	Lecture 6: Stability of Op Amp	Tutorial 3: Op Amp Circuits	Demo 2	
12	Lecture 7: Op Amp based Amplifiers		Demo 3	
	Lecture 8: Op Amp based Applications	Midterm Test	Demo 4	Assignment 2
13	Lecture 9: Analogue Filters		Lab 3: Power Amplifiers	Midterm Test

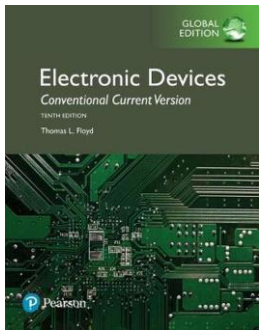
	Lecture 10: Power Amplifier	Tutorial 4: Analogue Filters	Demo 5	
14	Lecture 11: Linear Voltage Regulators		Demo 6	
	Lecture 12: Inductor and Transformer	Tutorial 5: Power Amplifiers	Demo 7	Assignment 3 Lab Report 3
15	Lecture 13: Switching Voltage Regulators		Lab 4: Power Supplies	
	Lecture 14: Thermal Analysis	Tutorial 6: Power Supplies	Demo 8	
16	Lecture 15: Noise Analysis		Demo 9	
	Lecture 16: PCB Design	Tutorial 7: Thermal and Noise Analysis	Demo 10	Assignment 4
17				Final Exam (TBA)
18				

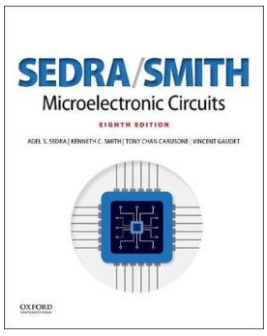
Textbook

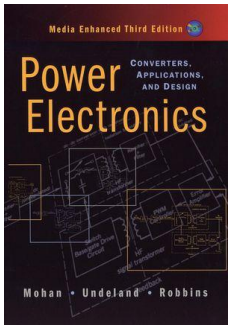
The recommended textbooks for the course are:

- Book 1 - “Design with Operational Amplifiers and Analog Integrated Circuits” (4th edition) by Sergio Franco. (Op Amp Analysis, Op Amp Circuits, and Noise).
- Book 2 - “Electronic Devices: Conventional Current Version” (9th edition) by Thomas Floyd. (Power Amplifier, Power Supply, and Analogue Circuits).
- Book 3 - "Microelectronic Circuits" (7th edition) by Adel Sedra & Kenneth Smith. (Filter, Oscillator, and Power Amplifier).
- Book 4 - "Power Electronics: Converters, Applications and Design” (3rd edition) by Ned Mohan, Tore M. Undeland & William P. Robbins. (Switch-Mode Power Supply, Thermal Analysis, and Transformer and Inductor Designs)









Various Industry Best Practice Technical Reports. (Op Amp Analysis, Filter, Thermal, Noise and PCB):

- Technical Report 1 – Analog Devices – MT-037 – Op Amp Input Offset Voltage
- Technical Report 2 – Analog Devices – MT-038 – Op Amp Input Bias Current

- Technical Report 3 – Analog Devices – MT-033 – Voltage Feedback Op Amp Gain and Bandwidth
- Technical Report 4 – Analog Devices – MT-045 – Op Amp Bandwidth and Bandwidth Flatness
- Technical Report 5 – Analog Devices – MT-046 – Op Amp Settling Time
- Technical Report 6 – Texas Instruments – SLOA020A – Stability Analysis of Voltage-Feedback Op Amps.
- Technical Report 7 – Texas Instruments - SNLA140D - Amplifier Circuit Collection.
- Technical Report 8 – Texas Instruments – Design of op amp sine wave oscillators.
- Technical Report 9 – Texas Instruments – SLOA093 – Filter Design in Thirty Seconds.
- Technical Report 10 – Texas Instruments - SNVA559C - Switching Regulator Fundamentals.
- Technical Report 11 – Analog Devices - MT-093 - Thermal Design Basics.
- Technical Report 12 – Texas Instruments – SLVA043B – Noise Analysis in Op Amp Circuit.

See the table in Appendix that outlines the mapping between the topics in the course and the relevant chapters in the reference textbooks and technical reports.

Workload

In order to maintain satisfactory progress in the course, you should plan to spend an average of at least 25-30 hours per week on this course for the planned compressed schedule (6 weeks in total). A plausible and approximate breakdown for these hours per week would be:

- Lectures and tutorial: 8 (6 hrs scheduled time + 2 review and practice).
- Reading: 3-4.
- Assignment: 3-4.
- Practical/laboratory/project: 6 (4.5 hrs practical session time + 1.5 hrs research).

Assessment

Your grade for the course will be determined based on the following assessment weightings:

Assessment	**Time**	**Learning Outcomes**	**Weight**
Laboratories (2 of 4)	Every 2 weeks	1,2,3,4	10%
Assignments (4)	Every 2 weeks	1,2,3	20%
Mid-Term Test	TBA	1,2	20%
Final Exam	TBA	1,2	40%
Attendance	All weeks	-	10%

There are four assignments and four laboratories. Only two of the lab reports will be assessed. These assessments will be weighted equally.

Course outcomes 1 and 2 will be assessed via the assignments and midterm test and exam. The assignments and laboratory reports will primarily assess course outcomes 2, 3 and 4.

The timetable for midterm test and final exam will be available later and informed to the students. The midterm test and final exam will be two hours long.

Paper non-English to English dictionaries will be permitted, as will silent, non-programmable calculators with cleared memory.

To pass the course, a student must gain at least overall mark of 60% (on XMUT scale). In addition, a student should:

- Achieve at least a 40% in the midterm test and final exam.
- Submit all the assignments and laboratory reports.

Announcements and Communication

The main means of communication are the course WeChat group and VUW's School of Engineering and Computer Science wiki website.

https://ecs.victoria.ac.nz/Courses/XMUT303_2026T2/WebHome

You will find, among other things, this document, lectures, laboratory and assignment handouts, etc.

Working Together and Plagiarism

We encourage you to discuss the principles of the course and assignments with other students, to help and seek help with programming details and problems involving the laboratory machines. However, any work you hand in must be your own work.

The school policy on plagiarism (claiming other people's work as your own) is available from the course home page. Please read it.

We will penalise anyone we find plagiarising, whether from students currently doing the course, or from other sources. Students who knowingly allow other students to copy their work may also be penalised.

If you have had help from someone else (other than a tutor), it is always safe to state the help that you got. For example, if you had help from someone else in writing a component of your code, it is not plagiarism as long as you state (e.g. as a comment in the code) who helped you in writing the method.

Expectations of Students in ECS courses

The School of Engineering and Computer Science strives to anticipate all problems associated with its courses, laboratories and equipment. We hope you will find that your courses meet your expectations of a quality learning experience.

If you think, we have overlooked something, or would like to make a suggestion, feel free to talk to the course coordinator or lecturer.

Appendix

Lecture	Lecture Topic	Tutorial	Book	Book Chapter	Page
1	Introduction to Course				
2	Operational Amplifiers	Tutorial 1	Book 1 (Franco)	Chapter 1 - Operational Amplifier Fundamental.	1-51
			Book 2 (Flyod)	Chapter 12 - Operational Amplifier.	602-635
3	Internal Op Amp Characteristics	Tutorial 1	Book 3 (Sedra & Smith)	Chapter 13 – Operational-Amplifier Circuits.	1028-1054
4	Static Limitation	Tutorial 2	Book 1	Chapter 5 - Static Op Amp Limitations.	221-260
			Technical Report 1	Op Amp Input Offset Voltage.	1-10
			Technical Report 2	Op Amp Input Bias Current.	1-5
5	Dynamic Limitation	Tutorial 2	Book 1	Chapter 6 - Dynamic Op Amp Limitations.	277-323
			Technical Report 3	Voltage Feedback Op Amp Gain and Bandwidth.	1-5
			Technical Report 4	Op Amp Bandwidth and Bandwidth Flatness.	1-6
			Technical Report 5	Settling Time.	1-4
6	Stability of Op Amp	Tutorial 2	Book 1	Chapter 8 – Stability.	371-422
			Technical Report 6	Stability Analysis of Op Amp.	1-26
7	Op Amp base Amplifiers	Tutorial 3	Book 1	Chapter 2 - Circuits with Resistive Feedback.	67-104
			Book 2	Chapter 13 - Basic Op Amp Circuits.	667-693
			Book 2	Chapter 14 - Special-Purpose Op Amp Circuits.	718-744
			Technical Report 7	Amplifier Circuits	1-42
8	Op Amp based Applications	Tutorial 3	Book 1	Chapter 9 - Nonlinear Circuits.	434-476
			Book 2	Chapter 16 – Oscillators.	806-835
			Book 3	Chapter 18 – Signal Generators and Waveform-Shaping Circuits.	1378-1427
			Technical Report 8	Oscillator Circuits.	1-5
9	Analogue Filters	Tutorial 4	Book 2	Chapter 15 - Active Filters.	763-788
			Book 3	Chapter 17 – Filters and Tuned Amplifiers.	1290-1367

			Technical Report 9	Filters Design.	1-14
10	Power Amplifier	Tutorial 5	Book 2	Chapter 7 - Power Amplifiers.	339-364
			Book 3	Chapter 12 – Output Stages and Power Amplifiers.	920-970
11	Linear Voltage Regulators	Tutorial 6	Book 2	Chapter 17 – Voltage Regulators.	851-878
12	Inductor and Transformer	Tutorial 6	Book 4 (Mohan, Undeland & Robbins)	Chapter 3 – Review of Basic Electrical and Magnetic Circuit Concepts.	46-56
			Book 4	Chapter 30 – Design of Magnetic Components.	744-788
13	Switching Voltage Regulators	Tutorial 6	Book 4	Chapter 10 – Switching DC Power Supplies.	301-348
			Book 4	Chapter 7 – DC-DC Switch-Mode Converters.	161-195
			Technical Report 10	Switching Regulator Fundamentals	1-29
14	Thermal Analysis	Tutorial 7	Book 3	Chapter 12 – Output Stages and Power Amplifiers.	971-981
			Book 4	Chapter 29 – Component Temperature Control and Heat Sinks.	730-741
			Technical Report 11	Thermal design basics	1-13
15	Noise Analysis	Tutorial 7	Book 1	Chapter 7 - Noise	333-370
			Technical Report 12	Noise Analysis of Op Amp Circuits.	1-20