UNSW Course Outline

ELEC2133 Analogue Electronics - 2024

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General Course Information

Course Code : ELEC2133
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Electrical Engineering & Telecommunications
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

The world we live in is fundamentally analogue in nature. Signals like electromagnetic waves received by cell phones, radios, and TVs, as well as ambient factors like temperature, pressure, movement, and sound, are all analogue in nature. However, despite their analogue origins, these

signals are processed and stored digitally using microprocessors and microcontrollers. Thus, analogue circuits are necessary in building the bridge between the analog and digital realms. Analog circuits are ubiquitous in everyday devices such as home appliances, vehicles, cell phones, medical equipment, computers, audio/video systems, and radio/TV sets, shaping our modern lives in profound ways.

Analogue circuits play a crucial role in performing key signal processing and conditioning functions like amplification, comparison, waveform generation, and analog-to-digital (A/D) as well as digital-to-analog (D/A) conversions. They typically comprise transistors, diodes, resistors, capacitors, and inductors, often integrated into circuit forms. In prior courses (ELEC1111 and ELEC2134), you learned circuit analysis techniques involving resistors, capacitors, and inductors. This course endeavors to expand on that knowledge by introducing you to analogue circuits with transistors and diodes, enhancing your skills in analyzing and designing such circuits. You will have the opportunity to apply the skills to implement analogue circuits and measure their performances such as amplifier gain and bandwidth in the laboratory setting. These implementations are critical in providing you with "hands-on" experiences that include circuit simulation, physical construction of the circuit, troubleshooting of circuits and using measurement laboratory equipment with safety at its core.

Course content includes: Device physics of diodes, BJTs and MOSFETs. Nonlinear transistor models: Ebers-Moll, transport. Full and simplified models of BJTs and MOSFETs (inc. small-signal models). Zener and Schottky diodes. DC biasing, biasing using current sources, operating point, large-signal analysis. Linearisation, small-signal analysis. Input and output impedances, power gain. Two-ports. Feedback, effects of feedback; stability and compensation techniques. Circuits with non-ideal op-amps. Common base, emitter and collector amplifiers; differential pairs. Multistage amplifiers, Cascades, Cascodes. AC response of 1-stage and multistage amplifiers, Miller effect. Non-linear circuits: oscillator, Schmitt trigger. Analogue-to-Digital converters (ADC) and Digital-to-Analogue Converters (DAC) principles.

Course Aims

The course is designed to enhance skills and knowledge in analyzing, designing, implementing and measuring electronic circuits with safety at its core. The first part of the course focuses on (i) the basic principle operations and device characteristics of diodes, Bipolar Junction Transistors (BJT), and Metal Oxide Semiconductor Field Effect Transistors (MOSFET) that underpin the analysis, design and implementation of analogue circuits; (ii) exploring multi-stage linear amplifiers, operational amplifiers, effects of feedback on the performance and stability of

amplifiers. The latter part of the course delves into nonlinear circuits such as Schmitt triggers, waveform generators, comparators, Analogue-to-Digital Converter (ADC), and Digital-to-Analogue Converters (DAC). Therefore, the course aims include:

- Enhancing skills and knowledge in analyzing and designing analog circuits, including amplifiers, operational amplifiers, comparators, and waveform generators.
- Introducing the fundamental operations, characteristics of diodes, BJT, and MOSFET transistors, and their application in circuit design.
- Developing a deeper understanding of the behavior of analog circuits and methods to enhance performance through feedback.
- Fostering an intuitive approach to circuit analysis and design.
- Introducing various ADC and DAC techniques along with their limitations.
- Safely implementing and measuring analyzed and designed analog circuits within a laboratory environment.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Design operational amplifier-based analogue circuits.
CLO2 : Apply the circuit models of transistors (BJT and MOSFET) in the analysis and design of linear multistage amplifier circuits.
CLO3 : Apply feedback concept in analyzing and improving performances of linear amplifier circuits including stability and frequency compensation techniques.
CLO4 : Develop an understanding of non-linear amplifier circuits in realizing waveform generators and oscillators.
CLO5 : Describe the operation of various types of D-A and A-D converter circuits including analysis and designing techniques.
CLO6 : Measure the performance of a range of implemented analogue circuits including operational amplifiers, multistage amplifiers, and waveform generators.

Course Learning Outcomes	Assessment Item
CLO1 : Design operational amplifier-based analogue circuits.	• Assignment • Laboratory assessment • Quiz • Final exam
CLO2 : Apply the circuit models of transistors (BJT and MOSFET) in the analysis and design of linear multistage amplifier circuits.	• Assignment • Laboratory assessment • Quiz • Final exam
CLO3 : Apply feedback concept in analyzing and improving performances of linear amplifier circuits including stability and frequency compensation techniques.	• Assignment • Laboratory assessment • Quiz • Final exam
CLO4 : Develop an understanding of non-linear amplifier circuits in realizing waveform generators and oscillators.	• Assignment • Laboratory assessment • Quiz • Final exam
CLO5 : Describe the operation of various types of D-A and A-D converter circuits including analysis and designing techniques.	• Quiz • Final exam
CLO6 : Measure the performance of a range of implemented analogue circuits including operational amplifiers, multistage amplifiers, and waveform generators.	• Laboratory assessment

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | ED Forum

Other Professional Outcomes

The Course Learning Outcomes (CLOs) contribute to the Engineers Australia (National Accreditation Body) Stage I competencies as outlined below

Engineers Australia (EA), Professional Engineer Stage 1 Competencies

PE1: Knowledge and Skill Base:

PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals: CLO 1, 2, 3, 4, 5

PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing: CLO 1, 2,3,4,5

PE1.3 In-depth understanding of specialist bodies of knowledge: CLO 1, 2, 3, 4

PE1.4 Discernment of knowledge development and research directions: n/a

PE1.5 Knowledge of engineering design practice: CLO 1, 2, 3, 5.

PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice: n/a

PE2: Engineering Application Ability:

PE2.1 Application of established engineering methods to complex problem solving: CLO 1, 3, 4, 5, 6

PE2.2 Fluent application of engineering techniques, tools and resources: CLO 1, 2,3, 4, 5, 6

PE2.3 Application of systematic engineering synthesis and design processes: n/a

PE2.4 Application of systematic approaches to the conduct and management of engineering projects: n/a

PE3: Professional and Personal Attributes:

PE3.1 Ethical conduct and professional accountability: n/a

PE3.2 Effective oral and written communication (professional and lay domains): CLO 5, 6

PE3.3 Creative, innovative and pro-active demeanour: CLO 6

PE3.4 Professional use and management of information: n/a

PE3.5 Orderly management of self, and professional conduct: n/a

PE3.6 Effective team membership and team leadership: n/a

This course is also designed to provide the course learning outcomes which arise from targeted graduate capabilities. The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate capabilities (also listed below).

Targeted Graduate Capabilities

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the school in conjunction with the requirements of professional and industry bodies:

- The ability to apply knowledge of basic science and fundamental technologies;
- The skills to communicate effectively, not only with engineers but also with the wider community;
- The capability to undertake challenging analysis and design problems and find optimal solutions;
- Expertise in decomposing a problem into its constituent parts, and in defining the scope of each part;
- A working knowledge of how to locate required information and use information resources to their maximum advantage;
- Proficiency in developing and implementing project plans, investigating alternative solutions, and critically evaluating differing strategies;
- An understanding of the social, cultural and global responsibilities of the professional engineer;
- The ability to work effectively as an individual or in a team;
- An understanding of professional and ethical responsibilities;
- The ability to engage in lifelong independent and reflective learning

UNSW Graduate Capabilities

The course delivery methods and course content directly or indirectly addresses a number of core UNSW graduate capabilities, as follows:

- Developing scholars who have a deep understanding of their discipline, through lectures and solution of analytical problems in tutorials and assessed by assignments and written examinations.
- Developing rigorous analysis, critique, and reflection, and ability to apply knowledge and skills to solving problems. These will be achieved by the laboratory experiments and interactive checkpoint assessments and lab exams during the labs.
- Developing capable independent and collaborative enquiry, through a series of tutorials spanning the duration of the course.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.
- Developing citizens who can apply their discipline in other contexts, are culturally aware and environmentally responsible, through interdisciplinary tasks, seminars and group activities

Additional Course Information

COURSE DETAILS

Credits

This is a 6 UoC course and the expected workload is 15 hours per week throughout the 10-week term.

Relationship to Other Courses

This is a 2nd year course in the School of Electrical Engineering and Telecommunications. It is a core course for students following a BE (Electrical) or (Telecommunications) program and other combined degree programs. It is a pre-requisite course for ELEC3106, ELEC3117, and ELEC4603.

Pre-requisites and Assumed Knowledge

The pre-requisite for this course is ELEC2134, Circuits and Signals. It is essential that you are familiar with fundamentals of circuit analysis techniques those concepts covered in ELEC1111 in addition to advanced techniques introduced in ELEC2134 before this course is attempted. You are strongly advised to revise those circuit analysis techniques from ELEC1111 and ELEC2134 in your own time to get yourself ready for this course. It is also further assumed that you are familiar with use of laboratory equipment such as oscilloscope, signal generator, power supply and multi-meters and have a good computer literacy.

Following Courses

The course is a pre-requisite for ELEC3106 (Electronics), ELEC3117 (Electrical Engineering Design) and ELEC4603 (Solid State Electronics).

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment Assessment Format: Individual	25%	Start Date: The first and second assignment will be released in Week 4 and 7, respectively Due Date: The due dates for assignment 1 and 2 will be in week 9 and 11, respectively
Laboratory assessment Assessment Format: Individual	25%	Start Date: Laboratory assessment begin in week 3 Due Date: Assessments due date vary depending on the task and the particular lab. Please consulate the lab manual for more detail
Quiz Assessment Format: Individual	10%	Start Date: The first quiz will begin in week 3, followed by subsequent quizzes every two weeks thereafter. Due Date: The last quiz will run in week 11.
Final exam Assessment Format: Individual	40%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Assignment

Assessment Overview

The course includes two assignments that entail one or more analytical and design problems. Students must provide comprehensive written solutions to these assignments and submit them via Moodle. The solutions should reflect the student's independent effort and reasoning, with clear justifications for any unique design approaches taken. Each assignment will be evaluated based on specific assessment criteria, and individual feedback will be shared with students on Moodle. Additionally, the solutions for the assignments will be made available on Moodle as general feedback for all students.

Course Learning Outcomes

- CLO1 : Design operational amplifier-based analogue circuits.
- CLO2 : Apply the circuit models of transistors (BJT and MOSFET) in the analysis and design of linear multistage amplifier circuits.
- CLO3 : Apply feedback concept in analyzing and improving performances of linear amplifier circuits including stability and frequency compensation techniques.
- CLO4 : Develop an understanding of non-linear amplifier circuits in realizing waveform generators and oscillators.

Detailed Assessment Description

The assignments constitute 25% of the overall mark. They will be released on Moodle in weeks 4 and 7, respectively. The due dates for submitting the comprehensive written solutions are in weeks 7 and 10. Students should provide justifications for any unique approach or design choice they make. Feedback on the assignments will be provided by weeks 9 and 11.

The first assignment will cover topics from the first five weeks, including op-amp amplifiers, amplifier design (BJT and MOSFET), and frequency response. The second assignment will focus on topics from the second five weeks of the course, including feedback, stability, and waveform generation.

Assignment submission Turnitin type

Not Applicable

Laboratory assessment

Assessment Overview

Prior to attending the lab sessions, completion of preliminary design problems is mandatory. During each lab exercise, there will be designated checkpoints that will be marked and signed off by laboratory demonstrators. At each checkpoint, there are multiple outcomes you need to demonstrate during the checkpoint assessment. It's highly recommended that you: (i) record your results in the designated spaces within the laboratory manual, and (ii) save any data plotted on the laboratory PC. You'll need to present your measurements and respond to questions posed by the lab demonstrator to showcase your comprehension of the concepts covered in each task. Your performance will be evaluated based on specific criteria outlined in the marking guidelines provided in the laboratory manual. While students will collaborate in pairs during the lab sessions, evaluations will be conducted individually. Each student will be assessed through individual questions, alongside a collective assessment for meeting the required lab objectives in pairs.

Additionally, online prelab quizzes will be conducted before each lab session, comprising 2 quizzes for Lab I, 3 for Lab II, and 1 for Lab III. These quizzes consist of multiple-choice questions with correct answers provided. The pre-lab quizzes will contribute 20% to the overall lab grade, which accounts for 5% of the total course grade. Thus, it is imperative that you arrive prepared for the lab by completing the preliminary problems and familiarizing yourself with the lab manual beforehand.

Course Learning Outcomes

- CLO1 : Design operational amplifier-based analogue circuits.
- CLO2 : Apply the circuit models of transistors (BJT and MOSFET) in the analysis and design of linear multistage amplifier circuits.
- CLO3 : Apply feedback concept in analyzing and improving performances of linear amplifier circuits including stability and frequency compensation techniques.
- CLO4 : Develop an understanding of non-linear amplifier circuits in realizing waveform generators and oscillators.
- CLO6 : Measure the performance of a range of implemented analogue circuits including operational amplifiers, multistage amplifiers, and waveform generators.

Detailed Assessment Description

The laboratory assessments will contribute 25% of the overall course mark. Demonstrators will be available to assist students with any questions or difficulties during the laboratory sessions. Upon completing a checkpoint, you will need to fill out an online Microsoft form (the link will be provided in the lab) where you can enter your details, including bench numbers, to be added to the marking queue. While waiting for the laboratory assessor to mark your work, you can continue working on subsequent lab design tasks. You will be required to show your measurements and answer questions from the assessor to demonstrate your understanding of the concepts covered in each task. The marking guidelines for the checkpoints are provided in the laboratory manual.

You are required to complete online pre-lab quizzes before each lab. To support you with the laboratory pre-lab quizzes, additional classes focusing on the lab topics will be organized by the course convenor on Teams and recorded. You are encouraged to attend these extra classes in weeks 2, 3, 4, 6, 7 and 8.

Laboratory work offers you with opportunities to earn bonus marks:

1. Each lab has pre-lab simulation tasks. By completing these tasks, you can earn up to 1 bonus mark per lab (Lab I: 2 bonus marks; Lab II: 2 bonus marks; Lab III: 1 bonus mark).
2. Designing and implementing a PCB for Lab II or III can earn you up to 10 bonus marks.

To assist you with LTSpice and PCB design, we will run two workshops in weeks 1 and 2 on Teams. These workshops will be recorded.

Your final lab mark will be calculated as L + B1 + B2, where L is the lab mark (out of 25%), B1 is the bonus mark for LTSpice or PSpice simulations, and B2 is the bonus mark for PCB design.

Assignment submission Turnitin type

This is not a Turnitin assignment

Quiz

Assessment Overview

The course incorporates ongoing assessment through biweekly online quizzes. These quizzes consist of multiple-choice questions derived from the topics discussed in lectures. They will be conducted during tutorial sessions every two weeks through Moodle. The first quiz is scheduled for week 3, followed by subsequent quizzes every two weeks thereafter. Feedback for each quiz will be shared with students via Moodle, including solutions to the quiz questions in the following week.

Course Learning Outcomes

- CLO1 : Design operational amplifier-based analogue circuits.
- CLO2 : Apply the circuit models of transistors (BJT and MOSFET) in the analysis and design of linear multistage amplifier circuits.
- CLO3 : Apply feedback concept in analyzing and improving performances of linear amplifier circuits including stability and frequency compensation techniques.
- CLO4 : Develop an understanding of non-linear amplifier circuits in realizing waveform generators and oscillators.
- CLO5 : Describe the operation of various types of D-A and A-D converter circuits including analysis and designing techniques.

Detailed Assessment Description

The purpose of these quizzes is to keep students up to date with the lecture material and to test their basic understanding of the course concepts. Students will be provided with similar quiz questions to help them prepare for the actual quiz, which will be administered during the last 10-15 minutes of their scheduled tutorial session. The quiz will be administered on Moodle. Each biweekly quiz will contribute equally to the overall quiz mark.

Assignment submission Turnitin type

Not Applicable

Final exam

Assessment Overview

The final examination for this course is a conventional closed-book 2-hour written test, including three mandatory questions. It constitutes 40% of the total grade. Approved university calculators are permitted for use. The exam assesses analytical thinking, critical reasoning, and overall

comprehension of the course content under controlled conditions. Questions may cover any aspect of the course, including lab work, unless specified otherwise by the instructor. Marks will be awarded based on the accuracy of responses.

Course Learning Outcomes

- CLO1 : Design operational amplifier-based analogue circuits.
- CLO2 : Apply the circuit models of transistors (BJT and MOSFET) in the analysis and design of linear multistage amplifier circuits.
- CLO3 : Apply feedback concept in analyzing and improving performances of linear amplifier circuits including stability and frequency compensation techniques.
- CLO4 : Develop an understanding of non-linear amplifier circuits in realizing waveform generators and oscillators.
- CLO5 : Describe the operation of various types of D-A and A-D converter circuits including analysis and designing techniques.

Detailed Assessment Description

Students must achieve at least 50% in the final exam to pass the course. The final exam will consist of three questions, and students should attempt all of them. A data sheet covering the two-port parameters, transistor (BJT and MOSFET) models, and equations related to the IV characteristics of BJT and MOSFET transistors will be provided. An example of the data sheet will be available on Moodle. Moreover, past final exam papers will be provided to aid in exam preparation. The final exam will cover all course topics. Summary videos, tutorial problem solutions and videos, and assignment questions will be most helpful for final exam preparation.

The course offers several activities through which students can earn bonus marks. These activities include:

1. **Pre-lab simulation tasks** : Completing these tasks can earn you up to 1 bonus mark per lab, with a total of 5 bonus marks available.
2. **Designing and implementing a PCB for Lab II or III**: Successfully completing this activity, which requires demonstrating a working circuit, can earn you up to 10 bonus marks.
3. **Practical project**: Completing a practical project can earn you up to 10 bonus marks.

The bonus marks collected by the student would be added to the final exam with total final exam mark capped to 100. With bonus marks, the final course result will be calculated as 0.25*L+0.25*A + 0.1*Q + 0.4*(F+B), where L is the laboratory mark (scaled to 100), A is the mark for assignments I and II (scaled to 100), Q is the total mark for quizzes scaled to 100, B is the total bonus mark calculated as B1+B2+B3 where B1 is the bonus mark for practical project, B2 is the bonus mark for pre-lab simulation, and B3 is the bonus mark for PCB design and

implementation , F is the final exam mark scaled to 100. F+B will be capped to the maximum of 100.

Assessment Length

2 hrs + 10 mins reading time

Assignment submission Turnitin type

Not Applicable

General Assessment Information

The assessment structure and weighting as outlined above will be applied in calculating the overall course mark at all times. However, in addition to those assessments, the course encourages and rewards students who go above and beyond by completing extra optional activities through which they can collect bonus marks.The activities are:

Practical projects

Practical projects are relatively challenging analogue electronics projects that involve design, simulation, implementation, and reporting tasks. Students who choose this option can either propose their own projects or select from those released in week 2. Proposals for student-initiated projects must be submitted on Moodle by the end of week 2 and approved by the course convener. Once approved or signed up for a practical project, students have until week 10 to complete the project and submit a report.

The report should document all aspects of the project, including design, analysis, simulation, and implementation. It can be submitted as either a written document or a recorded video, as long as it clearly covers the required aspects of the tasks. The key assessment criterion is how well students connect their practical work to the course topics, and demonstrating the application of course knowledge in their project.

The maximum mark for the practical project is capped at 10%, depending on the quality of the work. For example, students who go the extra mile to design and manufacture a PCB will receive more marks than those who implement their design on a breadboard. This is an individual project, and any form of plagiarism will have serious consequences.

The mark earned from the project will be added to the final exam mark (scaled to 100%) and capped to 100. If a student has 10 bonus mark from the project and earns 50% in the final exam, their final exam mark will be increased to 60%. If the student receives 10 bonus marks

from the project and earns 92% in the final exam, their final exam mark will be capped to 100.

Pre-lab simulations

These activities require students to apply circuit simulation tool, Spice or Pspice, to design and study the circuits that students would be implementing and perform measurements. Students who would complete these simulation tasks would receive bonus marks. There are 5 bonus marks available for collection in total with 1 or 2 bonus marks per lab.The bonus mark from these activities would be added to the final exam mark with the mark capped to 100.

PCB design and implementation

This activity involves designing and implementing a PCB for either lab II or III circuit. The activity is challenging for a 2nd year undergraduate students. The maximum bonus mark that can be received from this activity is 10. It will be added to the final exam mark with the mark capped to 100%.

Grading Basis

Standard

Requirements to pass course

- You must attend at least 80% of the lab - lab attendence is compulsary.
- You must pass the lab component of the course.
- You msut achieve at least 50% in the final exam of the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Operational amplifiers will be covered in the in-person lectures.
	Online Activity	Watch the video under week 1 section on Moodle. The video intends to introduce and revise concepts, which are relevant to this course but coverd in the previous pre-requesit courses. The content is also important for first quiz.
	Online Activity	Watch the supplementary Resources: Summary videos (Bode Plot) and summary videos (Op-amp)
Week 2 : 3 June - 9 June	Lecture	Semiconductor Devices for Electronics
	Tutorial	Revision - circuit analysis for analogue electronics (Tut 0)
	Online Activity	Watch Tutorial 0- Videos Attempt Exercise 1 (solution is provided)
	Online Activity	Lab I theory explained - online session to give you extra support with the lab I concepts will be organised. The session will be recorded for your reference.
	Online Activity	LTspice and PCB design workshops will be conducted as online sessions to introduce you to these tools. These resources will be helpful for completing lab simulation tasks, which can earn you bonus marks, as well as for some assignment problems and the optional PCB design task, which also offers bonus marks. The exact times for these sessions will be announced on Teams in due course. If you cannot attend, the sessions will be recorded for later viewing.
Week 3 : 10 June - 16 June	Lecture	Semiconductor Devices for Electronics continues this week Transitor Amplifiers (BJT and MOSFET); DC and small signal
	Tutorial	Operational amplifiers (Tut 1)
	Laboratory	Lab 1: Operational amplifiers - Design (should be completed before the labs session) Lab 1: Operational amplifiers - Gain and frequency response (set up circuit and measurement)
	Assessment	Quiz 1 will run during tutorial session. The last 10-15mins of the tutorial session will be used for running Quiz 1.
	Online Activity	Watch - Summary Videos (BJT Amplifier Analysis and configurations) Watch - Tutorial 1 vidoes Attempt - Exercise 2 (op-amp exercise) solution is provided
Week 4 : 17 June - 23 June	Lecture	Transistor Amplifiers (BJT and MOSFET): DC and small signal analysis continue Frequency response of Amplifiers
	Tutorial	Transistor amplifiers -DC and small signal (Tut 2)
	Laboratory	Lab 1: Operational amplifier - Frequency compensation
	Assessment	Assignment 1 will be released - due date in week 7
	Online Activity	Supplementary resources - watch Tutorial 2 - Videos and Summary videos (MOSFET Analysis and configuration)
	Online Activity	Lab II theory explained - this is an online session to give you extra support with lab II concepts and will be recorded.
Week 5 : 24 June - 30 June	Lecture	Frequency response of amplifiers continue Feedback in Amplifiers (part I)
	Tutorial	BJT Transitor amplifiers - Frequency response (Tut 3) MOSFET amplifiers - DC analysis, small signal and frequency response (Tut 3A)
	Online Activity	Supplemtray videos Watch - Tutorial 3 videos Watch - Tutorial 3A videos Watch - Summary videos (BJT, Frequency Anlysis) Watch - Summary Videos (BJT, Amplifier Analysis & Common configuration)
	Assessment	Quiz - 2 It will run during tutorial sessions in the last 10-15mins.
Week 6 : 1 July - 7 July	Tutorial	Catch up tutorial may run online if needed and recorded. Otherwise, this week is flexible week.
	Laboratory	Catch up labs may run if needed.
Week 7 : 8 July - 14 July	Lecture	Feedback in Amplifiers (Part II)
	Tutorial	MOSFET Transitor amplifiers - Frequency response (Tut 3A)
	Laboratory	Lab II: Feedback amplifier (open loop) - gain, bandwidth, input impedance and output impedance.

	Online Activity	Supplementary videos Watch - Summary Videos (Feedback Amplifiers)
	Assessment	Quiz -3 will run during the tutorial sessions.
	Assessment	Assignment 1 submission due.
	Assessment	Assignment 2 released
Week 8 : 15 July - 21 July	Lecture	Non-linear circuits - waveform generation
	Tutorial	Feedback amplifiers (Tut 4)
	Laboratory	Lab II: Feedback amplifier: two stage amplifiers (close-loop): gain, bandwidth, input impedance and output impedance withvarious feedback factors.
	Online Activity	Supplementary Resources (Videos) Watch - Summary Videos (Non-linear circuits) Watch - Tutorial 4 - Videos Attempt - Exercise-4 (Feedback amplifier) Attend Lab III theory explained - online extra session to give you support with lab III concepts will be organised and recorded.
Week 9 : 22 July - 28 July	Lecture	Feedback stability and compensation
	Tutorial	Feedback amplifiers (Tut 4)
	Laboratory	Lab III: Waveform generators -Schmitt Trigger
	Assessment	Quiz -4 will run during tutorial session.
	Online Activity	Attempt - Exercise -5 (Non-linear Circuits) Watch - Tutorial video 4
Week 10 : 29 July - 4 August	Lecture	Digital-analogue interface
	Tutorial	Waveform generators, DAC and ADC (Tut 5)
	Laboratory	Lab III: Waveform generators -VCO
	Online Activity	Supplementary Resources (Videos) Watch - Tutorial 5 - Vidoes
	Assessment	Assignment 2 - due
Week 11 : 5 August - 11 August	Assessment	Quiz - 5 will run online (one quiz for all students) on Mondays

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

Lectures - will run weekly on Wed (9am-11am, Law Theatre G04) and Fridays (11:00am -1:00pm, Ainsworth G03) in-person. The lecture will be streamed on Teams and recorded. However, in-person attendance is strongly encouraged.

Tutorials - will run weekly from week 2 onwards for 2 hours every even week and an hour for every odd week.

Laboratories - will run from week 3 onwards weekly for 3hrs. Attendance is compulsary.

Online activities - have been organised to support with labs, PCB design and Spice simulation tools. These activities will be scheduled, run on Teams and recorded for student who won't be able to attend them. Please note that the online activities are wholly extra support and are not sheduled by UNSW but by the course convener and may clash with your other commitments. The

course has supplementary videos - summary and tutorials. Students should watch them as per the schedule above (course schedule)

Assessments - Quizzes run during the tutorial sessions in week 3, 5, 7, and 9. Also in week 11 on Monday. Assignment 1 and 2 will be released in week 4 and 7 with repective the due dates in week 7 and 10.

Course Resources

Prescribed Resources

On-line resources

Moodle

The course web page is hosted on the UNSW's Moodle server, which can be accessed at: https://moodle.telt.unsw.edu.au/login/index.php. All lectures, tutorial, lab, video and any other notes will be available on this page, as well as access to the fortnightly quizzes, student marks, and official course announcements. It is a requirement of the course that students check this page for new announcements on a daily basis.

MS Teams

The course has MS Teams group for lecture, tutorial and laboratory. The group names for the lecture, laboratory and tutorial are CLS-ELEC2133_T2_5246_Lecture, CLS-ELEC2133_T2_5246_Laboratory and CLS-ELEC2133_T2_5246_Workshop, respectively. All lecture videos will be recorded and made available on this Teams group for students to watch them at time and place of their convenience. The MS Teams group will also be used to make announcements and students are required to check messages on daily basis.

ED Forum

The course wil also use ED forum for all discussions in the course.

Textbooks

Prescribed textbook

- Sedra & Smith, Microelectronic Circuits, 8th ed, Oxford University Press, 2011
- Richard C. Jaeger, Microelectronic Circuit Design, 6th Edition.

Recommended Resources

Reference books

- Millman & Grabel, Microelectronics, McGraw Hill, 2nded., NY
- Burns & Bond, Principles of Electronic Circuits, PWS, 2nd ed, 1997
- Higgins, Electronics with digital and Analog Integrated Circuits, 1983.
- Bogart, Electronic Devices and Circuits, 3rd ed, Merril, 1993.
- Horowitz & Hull, The Art of Electronics, 2nd ed, Cambridge University Press, 1989.

Course Evaluation and Development

This course is under constant revision in order to improve the learning outcomes for all students. Please forward any feedback (positive or negative) on the course to the course convener or via the Course and Teaching Evaluation and Improvement Process. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods. The following modifications are incorporated into the course

- The course has gone through Digital uplift. The purpose of the digital uplift is to enhance student experience in the course and support student learning. The uplift includes
  - Computer typed tutorial solutions: the previous tutorial solutions were hand-written, and they were problems with legibility. There were also errors in the solutions. These problems are now addressed in the new computer typed solutions.
  - Recorded tutorial solution videos: the benefit of tutorials has been reiterated strongly by students. With 1 hour of tutorial, it is often not possible to cover all tutorial problems. In order to address both the benefit of tutorial and coverage of tutorial problems, the tutorial solutions are now video recorded as they are being solved to provide additional virtual tutorial experience. Moreover, students will be able to watch the tutorial videos at their time of convenience.
  - Recorded summary videos: summary videos for each tutorial topic have been recorded. Students can watch those videos before coming to tutorial or attempting tutorial problems. In addition to supporting tutorial, the summary video will also help students with quick revision on important concepts in the course. Students are strongly advised to watch these videos (summary and tutorial videos) to get themselves ready exams in a short time possible.
  - Animations: In order to better illustrate the operational principle of diodes, BJT transistors, MOSFETs, Schmitt trigger and waveform generators, a number of animations have been created. Most of the animations are interactive and allow students to change parameters and variables to observe effect in a system.
  - Online assignment and reflection submission: in previous year assignment and reflection submissions were made in person by handing over a hard copy. This year, assignments and reflections will be submitted online on the Moodle web page of the course.

- Peer assessment (marking): assignment marking will be peer based this year. Each assignment submission will be randomly allocated to three students and each student will be allocated to mark three submissions. Peer assessment allows students to learn from the assessment experience as it requires them to first understand the problem and its solution and then apply it when marking. It will also allow them to learn from other peers and more importantly allow them to reflect on their submission from their peer's point of view.
- STACK questions: the questions will allow students to have the same problem but with different parameters and variables and thus conduct individual assessment. Students will be able to solve large problem in step-by-step manner and thus facilitate self-direct study.
- Remote laboratory: Laboratory will be conducted remotely through Microsoft Teams. Students will be given access to laboratory PC which is interfaced to web-based measurement equipment (oscilloscope, signal generator, multimeter) that are in turn connected to the laboratory experiments which are already implemented on the ELEC2133 PCB platform. The platform is especially designed to allow designed components to be easily plugged in and circuits to be reconfigured using jumpers. Once students provide their design values to the lab demo. The lab demo will set-up the desired circuit by simply plugging in those values on the board and give the students remote control to the laboratory PC through Microsoft Teams so that they can perform measurements.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Aron Michael		G17, 124	93855663	Monday 4:00pm - 5:00pm (online or face to face) and Friday 5:00pm-6:00pm	No	Yes
Head demonstrator	Yen Nee Ho					No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be

awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and

students may be asked to leave the class.

Use of AI for assessments

Your work must be your own. If you use AI in the writing of your assessment, you must acknowledge this and your submission must be substantially your own work. More information can be found on this website.

Workplace Health & Safety (WHS)

WHS for students and staff is of utmost priority. Most courses involve laboratory work. You must follow the rules about conduct in the laboratory. About COVID-19, advice can be found on this website.

School Contact Information

Consultations: Lecturer consultation times will be advised during the first lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC/TELExxxx in the subject line; otherwise they will not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle https://moodle.telt.unsw.edu.au/login/index.php. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Student Support Enquiries

For enrolment and progression enquiries please contact Student Services

Web

Electrical Engineering Homepage