School of Electrical Engineering and Telecommunications

Summer, 2021
Course Outline

ELEC2133
Analogue Electronics

COURSE STAFF

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Consultations: You are encouraged to ask questions on the course material via email to the <u>course assistant</u>. The consultation time for the course is on Wed from 2pm to 3pm online. Other consultation times may be arranged with the course assistant, but prior appointments must be made via email. You are welcome to email the course assistant 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 ELEC2133 Summer in the subject line, otherwise they will not be answered. In this course, Moodle will be used as an online learning and teaching platform. The course page on Moodle can be accessed at https://moodle.telt.unsw.edu.au/login/index.php. Students are also encouraged to post their questions on Moodle for discussion among their peers and academic staff of the course.

Keeping Informed: Announcements may be made 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.

COURSE SUMMARY

Contact Hours

The course consists of a total of 3-hour tutorial (in week 1-3) and a 2-hour tutorial (in week 4-5), and a 6-hour laboratory session from week 2-5. Although tutorial sessions are scheduled, the sessions will be used by the students to watch recorded tutorial videos and followed by an online discussion forum with the course assistant. There are no formal lecture schedules. Lecture records from previous years, summary videos, lecture materials and online resources will be made available on the course Moodle page and students are expected to cover these online resources during their own time. To help students plan their coverage of the online resources, a study schedule is provided as a guide and students are strongly advised to follow the study schedule. Laboratory sessions will start from week 2 and run online in remote laboratory mode. The first hour of the week 2 laboratory session may be run as trial session to familiarize students with the online remote lab environment before embarking on the real laboratory sessions. As remote lab may be new to students, their progress may be slow at the beginning but is expected to accelerate as they become familiar.

Tutorials	Day	Time	Location
	Wednesday	10am-1pm (week 1-3) and 10am-12pm (week 4-5)	Online
Labs	Monday	10am - 1pm (week 2-5)	Remote lab
	Monday	4pm - 7pm (week 2-5)	Remote lab
	Tuesday	10am - 1pm (week 2-5)	Remote lab
	Tuesday	4pm - 7pm (week 2-5)	Remote lab

Context and Aims

Analogue circuits are integral parts of any electronic system. They are used to realize important signal processing and conditioning functions such as amplification, comparison, waveform generation, analogue to digital and digital to analogue conversions. Analogue circuits consist of active circuit elements such as transistors and diodes in addition to resistors, capacitors, and inductors passive circuit elements often in an integrated circuit form. In previous courses, students were introduced to circuit analysis and synthesis techniques involving passive circuit elements. This course endeavours to build on this knowledge and further expand students' skill in analysing and designing analogue circuits involving transistors and diodes. The first half of the course covers: (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) multi-stage linear amplifiers, operational amplifiers, effects of feedback on the performance and stability of amplifiers. The second half of the course deals with nonlinear circuits such as Schmitt triggers, waveform generators, comparators, A/D, and D/A converters. Therefore, the aims of the course are

- To develop skill and knowledge in analysis and design of analogue circuits such as amplifiers, operational amplifiers, comparators, and wave form generators.
- To introduce the basic principle operations, device and circuit characteristics of diodes and BJT and MOSFET transistors
- To develop a more thorough understanding of why analogue circuits behave in a certain way and how performances can be improved when feedback is applied.
- To develop intuitive feel for circuit analysis and design
- To introduce various A/D and D/A conversion techniques and their limitations

Indicative Lecture Schedule

Period	Summary of Lecture Program
Week 1	Introduction and revision Operational Amplifiers Semiconductor Devices for Electronics **Assignment I released (Friday, midday)** **Fortnightly quiz 1 – released (Wednesday, midday)**
Week 2	Transistor Amplifiers (BJT and MOSFET): DC and small signal Frequency Response of Amplifiers **Assignment I due (Friday, midday)** **Assignment II released (Friday, midday)** **Fortnightly quiz 2 – released (Wednesday, midday)**
Week 3	Feedback in Amplifiers **Fortnightly quiz 3 – released (Wednesday, midday)** **Assignment II due (Friday, midday)** **Assignment III released (Friday, midday)**
Week 4	Stability and Compensation in feedback amplifiers Non-linear Circuits – Waveform generation **Mid-term exam (Monday, 12-1pm)** **Fortnightly quiz 4 – released (Wednesday, midday)**
Week 5	Digital-analogue interface (part I and part II) **Fortnightly quiz 5 – released (Wednesday, midday)** **Assignment III due (Friday, midday)**

Indicative Tutorial Schedule

Period	Summary of Tutorial Program
Week 1	Revision – circuit analysis for analogue electronics (Tut 0) Operational amplifiers (Tut 1)
Week 2	Transistor amplifiers – DC and small signal (Tut 2) BJT Transistor amplifiers – Frequency response (Tut 3)
Week 3	MOSFET Transistor amplifiers – Frequency response (Tut 3A)
Week 4	Feedback amplifiers (Tut 4)
Week 5	Waveform generators, DAC and ADC (Tut 5)

Indicative Laboratory Schedule

Period	Summary of Laboratory Program
Week 2	Lab I: Operational amplifier - Design (should be finished outside lab) Lab I: Operational amplifier - Gain and frequency response
Week 3	Lab I: Operational amplifier - Frequency compensation Lab II: Two stage amplifier – Design (should be finished outside lab) Lab II: Two stage amplifier (open loop)- input impedance, output impedance, gain, and bandwidth measurement
Week 4	Lab II: Feedback amplifier: two stage amplifiers(close-loop)-input impedance, output impedance, gain and bandwidth with various feedback factors
Week 5	Lab III: Waveform generators - Schmitt Trigger Lab III: Waveform generators - VCO

As the summer course is short, intense, and online, the following schedule is prepared to help students with their planning of study and monitoring their progress. Its importance is crucially important, and students are strongly advised to follow the study schedule. Resources indicated in red text are "Must be covered".

Study schedule

Period	Lecture material	Lecture video	Tutorial material/video	Assessment
Week 1	• Week 1(introduction & Operational amplifiers) • Week 1 (Semiconductor devices)	• ELEC2133 introduction video • Summary Video (Bode plot) • Summary Videos (Op-amp) • Week 1 - Lecture recording – Operational amplifier • Week 1 (Semiconductor devices-BJT) • Week 1(Semiconductor devices-MOSFET and transistor modelling) • Under Lecture records Section – all Week 1 videos	• Tute 0 • Tutorial 0 – videos • Tute 0- solution • Tutorial video (Revision and Opamps) • Tute 1 • Tutorial 1 -Videos • Tute 1-Solution • Week 1 – tutorial Video (opamps)	• Assignment 1 released • Quiz -1 released • Exercise - 1 completed • Exercise – 2 completed

Week 2	• Week 2 – part 1 (Transistor Amplifiers) • Week 2 – part 2 (Transistor Amplifiers) • Week 2 (Frequency Response of Transistor Amplifiers)	• Summary Videos (BJT Amplifier Analysis and configurations) • Summary Videos (MOSFET Amplifier Analysis and configuration) • Summary videos (BJT, Frequency Analysis) • Week 2 – Lecture video 1 • Week 2 – Lecture video 2 • Week 2 – Lecture video 3 • Week 2 – Lecture video 4 • Under "Lecture records" section – all week 2 videos	• Tute 2 • Tutorial 2 -Videos • Tute 2 -Solution • Week 2- Tutorial video 1 or Week 2 – Tutorial video 2 • Tute 3 • Tutorial 3 – videos • Tute 3 - Solution • Week 2 – Tutorial Video 3 or Tutorial Video 4	• Assignment 1 submitted • Assignment 2 released • Quiz -1 completed • Quiz -2 released • Exercise -3 completed
Week 3	Week 3 (Feedback in amplifiers)- 1 Week 3 (Feedback in Amplifiers) - 2	• Summary Videos (Feedback amplifiers) • Week 3 – Lecture video 1 • Week 3 – Lecture video 2 • Week 3 – Lecture video 3 • Under "Lecture records" section – all week 3 videos	• Tute 3A • Tutorial 3A – videos • Tute 3A - Solution • Week 3 – Tutorial video 1 or Tutorial video 2	• Assignment 2 submitted • Assignment 3 released • Quiz -2 completed • Quiz -3 released
Week 4	Week 4 (Non-linear circuits) Week 4 (Feedback Stability and Compensation)	• Summary Videos (Non-linear circuits) • Week 4 – Lecture video 1 • Week 4 – Lecture video 2 • Week 4 – Lecture video 3 • Under "Lecture records" section – all week 4 videos	• Tute 4 • Tutorial 4 – Videos • Tute 4 – Solution A • Week 4 – Tutorial video 1 • Week 4 – Tutorial video 2	• Quiz -3 completed • Quiz -4 released • Exercise – 4 completed
Week 5	Week-5(Digital - Analog Interface)	• Week 5 – Lecture video 1 • Week 5 – Lecture video 2 • Under "Lecture records" – all week 5 videos	• Tute 5 • Tutorial 5 – Videos • Tute 5 – Solution • Week 5 – Tutorial video 1 or Tutorial video 2 • Week 5 – Tutorial video 3 or Tutorial video 4	• Assignment 3 submitted • Quiz-4 completed • Quiz-5 released • Exercise-5 completed

Assessment

Laboratory Practical Experiments (including reflection)	20%
Mid-term Exam (1 hour)	10%
Fortnightly quizzes (must be completed)	0%
Assignments (peer marking must be completed)	15%
Final Exam (2 hours)	55%

COURSE DETAILS

Credits

This is a 6 UoC course and the expected workload is 30 hours per week throughout the 5-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).

Learning outcomes

After successful completion of this course, you should be able to:

1. Demonstrate the use of operational amplifiers in realizing various analogue functions.
2. Analyse and design various analogue electronic circuits based on operational amplifiers.
3. Explain the basic principle of operations of diodes, BJTs and MOSFETs.
4. Demonstrate the use of circuit models of diodes, BJTs and MOSFETs in the analysis and design of electronic circuits.
5. Analyse, design, and implement various multi-stage linear amplifier circuits.
6. Identify various feedback topologies for amplifiers and explain their advantage and disadvantage.
7. Analyse, design and implement feedback amplifiers.
8. Explain the behaviour and applications of oscillators.
9. Analyse, design and implement waveform generators and voltage control oscillators using Schmitt trigger.
10. Describe and identify the operations of various D-A and A-D convertor circuits.
11. Analyse and design typical D-A and A-D convertor circuits.

This course is designed to provide the above learning outcomes which arise from targeted graduate capabilities listed in ***Appendix A***. The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate capabilities (listed in ***Appendix B***). This course also addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in ***Appendix C***.

Syllabus

Device physics of diodes, BJTs and MOSFETs, Nonlinear transistor models: Ebers-Moll, Full and simplified models of BJTs and MOSFETs (inc. small-signal models). Zener diodes, DC biasing, biasing using current sources, operating point, large-signal analysis, Linearization, small-signal analysis, Input and output impedances. Voltage gain. Current gain, Transimpedance gain, Transconductance gain, Two-ports. Feedback amplifiers: Effects of feed-back in amplifiers; stability and compensation techniques, Circuits with non-ideal op-amps. Common base, emitter and collector amplifiers; Common gate, drain, and source; Differential pairs, Multistage amplifiers, Cascades, Cascodes; AC response of amplifiers, Miller effect, Non-linear circuits: Oscillator, Schmitt trigger. A-D and D-A converter principles.

TEACHING STRATEGIES

Delivery Mode

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Pre-recorded lectures, summary videos, and lecture notes, which provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding.
- Tutorial videos, on-line discussion forums (on Microsoft Teams and Moodle) , and tutorial problem solutions, which allow you to apply concepts introduced in lecture in solving analytical and design-based problems.
- Remote laboratory sessions, which support the formal lecture material and provide you with Pspice circuit simulation, and measurement skills. Students will have access to web-based oscilloscope, signal generator and multi-meter through Microsoft teams. They will be able to do measurements remotely and analyse those measurements which will give them practical understanding of the concepts covered in the lectures.
- Online fortnightly quizzes and stack questions, which allow you to assess yourself and get feedback to support your self-direct learning and understanding of materials covered in the course.

Learning in this course

You are expected to watch <u>all</u> the pre-recorded lectures, summary, and tutorial videos and attend the on-line discussion forums, labs, and mid-term exams in order to maximize learning. You must prepare well for your laboratory classes and your lab work will be assessed. In addition to the lecture notes/video, you should read relevant sections of the recommended text. Reading additional texts will further enhance your learning experience. Group learning is also encouraged. UNSW *assumes* that self-directed study of this kind is undertaken in addition to attending online classes throughout the course.

Lecture classes

Although there are no formal face-to-face or online lecture classes in summer, lecture and summary videos on each topic are available for the students to watch. The videos are supported by lecture slides and notes which will be uploaded on Moodle and prescribed textbook that contains detailed explanations of the topics. The lectures form the core of this subject. Topics presented in lectures will generally be followed by detailed examples to provide students with the real-life applications.

Tutorial classes

The tutorial problems provide students with in-depth quantitative understanding of the topics covered in lectures. The problems will be posted on Moodle prior to releasing the tutorial videos and solutions. Students are encouraged to attempt them before watching the tutorial videos. Discussion forum will be held online to discuss the problems covered in the tutorial videos. The forum will provide students with opportunities to raise questions that they might have in the tutorial problems or topics and get answers from the academic staff and their peers. During the scheduled tutorial session, students are expected to watch the tutorial videos followed by the discussion forum. Complete worked out solutions in the forms of text will be uploaded on Moodle after the tutorial so that students can go through them at their time of convenience. To further support the tutorial, summary videos on important concepts related to materials covered in each tutorial have been prepared and will be made available before the tutorial. Students can watch the summary videos before attempting the tutorial problems. They can also use the videos for quick revision on important topics to prepare themselves for formative and summative assessments in the course. The importance of adequate preparation prior to attempting each tutorial and attending discussion forums cannot be overemphasized, as the effectiveness and usefulness of the tutorial depends to a large extent on this preparation.

Laboratory program

The laboratory schedule is deliberately designed to provide practical exposure to the concepts conveyed in lectures. Students will be able to operate web-based instruments that are connected to the laboratory experiments remotely. There will be three laboratory experiments in the course, each of which consisting of either two or three parts. The experiments are supported with detailed theoretical background in addition to concepts introduced in lectures and design guidelines that you are required to step through to complete preliminary preparatory problems. You must attend the laboratory having read the laboratory notes and completed the preliminary laboratory problems. Laboratory demonstrator will mark your preliminary preparatory solutions. **You will not be marked and lose points if you are attending the remote laboratory session without completing the preliminary preparatory design tasks.** Based on the design, the lab demonstrator will set up your designed circuit on the ELEC2133 PCB board by simply plugging-in resistors and capacitors with the designed values and jumpers for electrical connections. You will then be able to reconfigure the set up using relay switches with lab view interface and will be able to monitor the values that are plugged into the board through remotely controlled cam. Through Microsoft team, they will be given control to operate the laboratory equipment remotely as if you are working in the

lab. To help you with monitoring the set up and conducting measurement, manuals and videos have also been prepared for you to refer in the laboratory manual.

Regular laboratory sessions will run from **week 2 to week 5** every week. To help students familiarize with the remote lab environment and settings, there will be a trial laboratory session in **week 2 for the first hour or so**. Laboratory attendance WILL be kept, and you **MUST attend at least 80% of the labs in order to pass the course**.

The laboratory manual will be made available on Moodle. All data and marks will be recorded in spaces provided in the laboratory manual. The student will share those data with the marker on Microsoft Teams to be marked and signed off for each check point

Laboratory Exemption

There is no laboratory exemption for this course. Regardless of whether equivalent labs have been completed in previous courses, all students enrolled in this course must take the labs. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend a lab, you will need to apply for a catch-up lab during another lab time, as agreed by the laboratory coordinator.

ASSESSMENT

The assessment scheme in this course reflects the intention to assess your learning progress through the term. Ongoing assessment occurs through the lab checkpoints (see lab manual), lab reflections, three assignments and the mid-term exam.

Laboratory Assessment

The laboratory work will contribute to 15% of the overall mark. It is essential that you complete the laboratory preparation before coming to the lab. Your laboratory preparation will be marked and checked. Each lab exercise will have three checkpoints. Each checkpoint is expected to be completed in one week or less. It will be marked and signed off by your dedicated laboratory demonstrators. Although there is only one check point for each week, there are a number of results that you are required to demonstrate when marked for the check point. Therefore, you are strongly advised to: (i) record results in spaces provided in the laboratory manual; (ii) save the data plotted on the laboratory PC. Demonstrators will be available to help students with any questions or difficulties.

Upon completion of a checkpoint, you will be required to fill in an online Microsoft form (the link of which will be provided later) in which you can enter your details including bench numbers to be on the marking queue sheet and wait for the laboratory assessor to mark your work. You may continue working on the subsequent lab design tasks while waiting to be assessed. You will be required to show the measurements you took and answer questions asked by the assessor to demonstrate your understanding of the ideas addressed within each task. The marking guidelines are provided in the laboratory manual.

Students will work in pair but be marked individually. Each student will be asked a couple questions for individual marking. There will also be a group mark for demonstrating the required lab tasks in pair.

Laboratory Reflection

You will be required to write an individual laboratory reflection at the end of lab I, lab II, and lab III. Detail on how to write and what to include in the reflection will be provided. The reflection does not have a word limit but is not expected to be long and generally less than 500 words. It can be handwritten as long as it is legible. You will submit the reflection online on Moodle after you are marked for the lab either in the same or following week. It will contribute 5% towards the overall mark. The assessment will provide you with the opportunity to reflect on your laboratory experience, what you have learnt from the experience and give your general feedback about the lab tasks. It will also help us to improve the delivery of the lab and better support your individual needs based on your experience and feedback.

Fortnightly quizzes

There will be fortnightly quizzes throughout the term. The purpose of the quizzes is to keep students up to date with the lecture material and to test their basic understanding of the course concepts. The fortnightly quizzes will not contribute to the overall mark. However, the quizzes are mandatory component of the overall assessment and **students must attempt all quizzes to pass this subject. Moreover, for each quiz not attempted within the due date, you may lose one mark.** Each quiz will consist of a number of multiple-choice questions and will be

marked according to the number of correct answers. Each quiz will be available for a period of two weeks and the results per quiz will be published at the end of the period.

The quizzes will be delivered through Moodle and will each be made available for a period of one week from Saturday 9:00am to the following Saturday at the same time after which a new quiz will become available. The first quiz will be released at end of week 1.

Mid-Term Exam

The mid-term examination in this course is a 1-hour supervised test based on two design questions. Questions will be drawn from the first five topics of the course (week 1- week 2), unless specifically indicated otherwise by the lecturer. It will contribute 10% to the overall mark. University approved calculators are allowed. The examination tests analytical and critical thinking and general understanding of the course material in a controlled fashion.

Assignment

The assignments, which will consist of analysis and design problems, form 15% of the overall mark. There will be three assignments for this course. They will be released on Moodle at the end of week 1, 2 and 3. The assignments are to be submitted online on Moodle and due at the end of week 2, 3 and 5, respectively. Late submission will attract a penalty of 5% per day (including weekends).

Assignments will be peer assessed. This means that you will mark the assignment submissions of your peers and your peers will mark your submission. Each student will be allocated three assignment submissions to mark and each submission will be marked by three students. The average mark given by the three students will be the mark for the submission. Detail rubrics and solution will be provided to help students with marking. Further information on peer marking will be made available on Moodle in due course. **It should be noted that your peer marking will be given a mark, which contributes to your overall assignment mark. Therefore, it is important to make sure that you undertake the peer markings in order not to lose any marks for the assignments.**

The assignments will consist of one or more analytical and design problems and students are required to provide a complete solution. Students will be expected to work independently and be able to justify any unique design choices along the way.

Final Exam

The final examination in this course is a standard closed-book 2-hour written examination, comprising four compulsory questions. It is worth 55% of the overall mark. University approved calculators are allowed. The examination tests analytical and critical thinking and general understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course (including laboratory), unless specifically indicated otherwise by the lecturer. Marks will be assigned according to the correctness of the responses. *Please note that you must pass the final exam in order to pass the course.*

Relationship of Assessment Methods to Learning Outcomes

Assessment	Learning outcomes										
	1	2	3	4	5	6	7	8	9	10	11
Laboratory practical assessments	✓	✓	-	-	✓	✓	✓	-	✓	-	-
Laboratory reflection	✓	✓	-	-	✓	✓	✓	✓	✓	-	-
Fortnight online quizzes	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓
Assignment	✓	✓	-	✓	✓	✓	✓	-	✓	-	-
Mid-term exam	✓	✓	✓	✓	✓	-	-	-	-	-	-
Final exam					✓	✓	✓	✓	✓	✓	✓

COURSE RESOURCES

Textbooks

Prescribed textbook

- Sedra & Smith, *Microelectronic Circuits*, 6th ed, Oxford University Press, 2011

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.

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, discussion forums and official course announcements. It is a requirement of the course that students check this page for new announcements on a daily basis.

Mailing list

Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your student email address).

OTHER MATTERS

Dates to note

Important Dates available at: https://student.unsw.edu.au/dates

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/guide), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both online classes and *independent, self-directed study*. In periods where you need to need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes, they may be refused final assessment.

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.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. Be aware of the "fit to sit/submit" rule which means that if you sit an exam or submit an assignment, you are declaring yourself well enough to do so and cannot later apply for Special Consideration. For more information and how to apply, see https://student.unsw.edu.au/special-consideration.

Continual Course Improvement

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 online student survey myExperience. 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.

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- 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.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:
https://student.unsw.edu.au/guide
https://www.engineering.unsw.edu.au/electrical-engineering/resources

APPENDICES

Appendix A: 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.

Appendix B: 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

Appendix C: Engineers Australia (EA) Professional Engineer Competency Standard

	Program Intended Learning Outcomes	
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals	✓
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing	✓
	PE1.3 In-depth understanding of specialist bodies of knowledge	✓
	PE1.4 Discernment of knowledge development and research directions	
	PE1.5 Knowledge of engineering design practice	✓
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice	
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving	✓
	PE2.2 Fluent application of engineering techniques, tools and resources	✓
	PE2.3 Application of systematic engineering synthesis and design processes	
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability	
	PE3.2 Effective oral and written communication (professional and lay domains)	✓
	PE3.3 Creative, innovative and pro-active demeanour	✓
	PE3.4 Professional use and management of information	✓
	PE3.5 Orderly management of self, and professional conduct	
	PE3.6 Effective team membership and team leadership	

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