ELEC676

Electronic Devices and Systems

S2 Day 2019

School of Engineering

Contents

Disclaimer

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General Information

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Credit points
4

Prerequisites
Admission to MEng

Corequisites

Co-badged status
ELEC676

Unit description
This unit further develops the topics of analogue circuit theory and practice with an emphasis on design. It covers transfer functions, circuit simulation, semiconductor devices, basic transistor amplifiers, operational-amplifier circuits and some more advanced topics which may include analogue filters, noise and design issues.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.

Understand the basic semiconductor devices, their operation and non-linear behaviour

Apply nonlinear device concepts to the design and analysis of transistor amplifiers.

Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.

Analyse the operation of power amplifiers in the time and frequency domains.

Design, simulate, implement, test and debug electronic circuits and systems

General Assessment Information

Notifications

Formal notification of assessment tasks, grading rubrics, and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, The University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

Weekly Plan

A weekly plan of lectures, assignments, tests, laboratory and workshop sessions will be posted on iLearn. Students are expected to consult it and be aware of possible minor variations.

Assignment Tasks

Assignment questions will be posted on iLearn at least two weeks before their submission date.

Assignments will be in the form of iLearn quizzes and must be completed and electronically submitted prior to their due date. Solutions and feedback will be provided two weeks after the submission due date.

All assignments should be prepared individually. It is expected that students consult tutors, lecturers or other students while learning the concepts, but copying assignments from others is not accepted. Students are expected to have read and understood the academic honesty policy.

Assignment questions will come from a question bank and in some cases have variable numbers. Whilst all students will face similar questions, the numerical details and therefore the correct solution will vary. Marks will be awarded only to correct answers that are within the tolerance level set by the examiner, in other words, there will be no marks for trying.

Absences

Late notices or absences from tests and laboratories will be considered under extenuating circumstances upon lodgement and approval of a formal notice of disruption of studies.

Grading

In order to pass this unit, a student must obtain a mark of 50 or more overall or obtain a passing grade P/ CR/ D/ HD.

Late submissions & Special Consideration

Late submissions of assignment or lab reports will not be allowed unless a formal disruption of studies has been submitted. Assignment solutions will be posted to iLearn two weeks after submission. After solutions are posted no more late submissions will be accepted.

If you receive special consideration for the final exam, a supplementary exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal exam period. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

Assessment Tasks

Name	Weighting	Hurdle	Due
Final Closed Book Examination	40%	No	TBA
Laboratory	30%	No	Check iLearn
Take-home assignments	20%	No	Check iLearn
Pre-classroom Online Quiz	5%	No	Before the classroom time
Mini-exam	5%	No	TBA

Final Closed Book Examination

Due: **TBA**
Weighting: **40%**

A final closed-book examination (3hrs+10mins reading time) will be conducted during the formal examination period. A formula sheet will be provided. Calculators with no text-recall functions are permitted.

This examination will assess all topics discussed in the unit, unless otherwise specified.

On successful completion you will be able to:

- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.

- Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Analyse the operation of power amplifiers in the time and frequency domains.

Laboratory

Due: **Check iLearn**
Weighting: **30%**

The experiments are designed to explore the practical aspects of the theory discussed in the unit. You will need to perform the experiments in teams of two. There are Four lab modules in total. Modules 1 and 2 spans for 3 weeks and modules 3 and 4 spans for 2 weeks. Students are required to submit **two individually written** reports on the second and third lab modules. Check iLearn for their submission dates.

Assessed activities in the Lab: (50%)

- Pre-lab work: 20%
- Logbook: 20%
- Lab participation and results: 60%

Assessed contents in the report: (50%)

- Originality
- Format, clarity, and relevance of the contents
- Technical writing skills
- Analysis of the results
- Abstract and Conclusion

More on lab sessions

Practical sessions start in Week 2. They are comprised of weekly 3-hour laboratory sessions linked to each learning outcome, and they are compulsory for all students. Students are expected to arrive on time and use laboratory time efficiently. Students should enroll in one practical class at the beginning of the semester. Switching a practical class during the semester is not possible unless a formal application of "disruption to studies" is approved.

All practical sessions are based on the learning outcomes of this unit and students are required to review the concepts introduced in lectures before coming to each session. Laboratory or workshop worksheets will be posted on iLearn prior to the weekly sessions and it is compulsory for students to complete the preparatory work before coming to the session.

Food and drink are not permitted in the laboratory. Students will not be permitted to enter the laboratory without appropriate footwear. Thongs and sandals are not acceptable.

Logbooks

Each student must have a bound notebook to be used as a logbook (A4 size preferred, graph pages are not required). This logbook should be used for all practical work including preliminary and post (reflection) work. It should contain dates, calculations, and results recorded during these sessions, in chronological order. On the completion of each session, logbook entries must be signed and dated by a tutor. Logbooks must be kept in good order for a final check at the end of the semester. Your pre-lab works need to be done in the log book before coming to the lab.

On successful completion you will be able to:

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
- Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Analyse the operation of power amplifiers in the time and frequency domains.
- Design, simulate, implement, test and debug electronic circuits and systems

Take-home assignments

Due: **Check iLearn**
Weighting: **20%**

These questions are to be solved at home on the concepts and particular learning outcomes and to be submitted electronically to iLearn. There will be 4 assignments in total. Details of each assignment will be updated on iLearn. There will be four take-home assignments on four specific topics covered in the unit.

On successful completion you will be able to:

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
- Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Analyse the operation of power amplifiers in the time and frequency domains.

Pre-classroom Online Quiz

Due: **Before the classroom time**
Weighting: **5%**

Students are expected to go through the online learning content, understand the theory and attempt the online quizzes each week before attending that week's classroom activities. Students can do so at their own pace, time and place. Please note that the quizzes for the week will close before the start of that week's classroom activity. Two attempts are allowed, but only the marks from the first attempt will be considered.

On successful completion you will be able to:

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
- Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Analyse the operation of power amplifiers in the time and frequency domains.
- Design, simulate, implement, test and debug electronic circuits and systems

Mini-exam

Due: **TBA**
Weighting: **5%**

This is a 1hour closed book examination. Mini-exam will be conducted in Week-12 or 13 in the classroom during regular classroom hours. This exam will be in the same format as the final exam and will give you a taste of the final examination. The date of the mini-exam will be announced at least 2 weeks before the mini-exam.

On successful completion you will be able to:

- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
- Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Analyse the operation of power amplifiers in the time and frequency domains.

Delivery and Resources

Recommended texts:

Sedra and Smith- Microelectronic Circuits 6th Edition. The material will also cover other books and journal articles. Reading recommendations will be provided through iLearn.

Technology used:

Typical electronic and electrical instruments such as voltage and current sources, voltmeters, ammeters, oscilloscopes, circuit simulation software, PSPICE, and word processor software will

be used. Access to these resources will be available in the laboratory during the scheduled sessions.

Library and Internet:

Links to resources and literature will be provided in the iLearn.

Unit Schedule

A detailed schedule will be posted on iLearn.

Learning and Teaching Activities

Directed self study through pre-classroom activities

Resources and links posted on iLearn are expected to be reviewed and studied by all students before each class. Make a note of your questions and difficult concepts to be discussed in the classroom.

Lectorials

Lectorials introduce students to the advanced level knowledge which builds on what they learned from the pre-classroom activities. This will include problem-solving exercises and reviewing the important (or difficult) topics. It will be assumed that information linked in iLearn is studied prior to the lectorial.

Laboratory

Develop skills based competencies in experimentation with overlap/application to theory and simulation. A significant portion of the laboratory effort is expected to be an exploration of the posed problem and of operation and setting up of equipment. Laboratory worksheets are provided to guide student work and will be available on iLearn at least 1 week prior to each laboratory session.

Consulting Hours

The course instructor will be available for consulting. Please check the beginning page of the unit guide for the consulting hours.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy

- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
- Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Analyse the operation of power amplifiers in the time and frequency domains.
- Design, simulate, implement, test and debug electronic circuits and systems

Assessment task

- Take-home assignments

Learning and teaching activity

- Resources and links posted on iLearn are expected to be reviewed and studied by all students before each class. Make a note of your questions and difficult concepts to be discussed in the classroom.
- Lectorials introduce students to the advanced level knowledge which builds on what they learned from the pre-classroom activities. This will include problem-solving exercises and reviewing the important (or difficult) topics. It will be assumed that information linked in

iLearn is studied prior to the lectorial.

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Design, simulate, implement, test and debug electronic circuits and systems

Learning and teaching activities

- Resources and links posted on iLearn are expected to be reviewed and studied by all students before each class. Make a note of your questions and difficult concepts to be discussed in the classroom.
- Lectorials introduce students to the advanced level knowledge which builds on what they learned from the pre-classroom activities. This will include problem-solving exercises and reviewing the important (or difficult) topics. It will be assumed that information linked in iLearn is studied prior to the lectorial.
- Develop skills based competencies in experimentation with overlap/application to theory and simulation. A significant portion of the laboratory effort is expected to be an exploration of the posed problem and of operation and setting up of equipment. Laboratory worksheets are provided to guide student work and will be available on iLearn at least 1 week prior to each laboratory session.

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcome

- Demonstrate active self-learning, critical thinking, problem-solving, technical report

writing and time-management - individually and in a team.

Assessment task

- Pre-classroom Online Quiz

Learning and teaching activity

- Resources and links posted on iLearn are expected to be reviewed and studied by all students before each class. Make a note of your questions and difficult concepts to be discussed in the classroom.
- Lectorials introduce students to the advanced level knowledge which builds on what they learned from the pre-classroom activities. This will include problem-solving exercises and reviewing the important (or difficult) topics. It will be assumed that information linked in iLearn is studied prior to the lectorial.
- The course instructor will be available for consulting. Please check the beginning page of the unit guide for the consulting hours.

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
- Apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Analyse the operation of power amplifiers in the time and frequency domains.
- Design, simulate, implement, test and debug electronic circuits and systems

Assessment tasks

- Final Closed Book Examination
- Laboratory
- Take-home assignments
- Pre-classroom Online Quiz

- Mini-exam

Learning and teaching activities

- Resources and links posted on iLearn are expected to be reviewed and studied by all students before each class. Make a note of your questions and difficult concepts to be discussed in the classroom.
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- The course instructor will be available for consulting. Please check the beginning page of the unit guide for the consulting hours.

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
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Assessment tasks

- Final Closed Book Examination
- Laboratory

- Take-home assignments
- Pre-classroom Online Quiz
- Mini-exam

Learning and teaching activities

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- The course instructor will be available for consulting. Please check the beginning page of the unit guide for the consulting hours.

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Understand the basic semiconductor devices, their operation and non-linear behaviour
- Apply nonlinear device concepts to the design and analysis of transistor amplifiers.
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Assessment tasks

- Final Closed Book Examination
- Laboratory
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- Resources and links posted on iLearn are expected to be reviewed and studied by all students before each class. Make a note of your questions and difficult concepts to be discussed in the classroom.
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- The course instructor will be available for consulting. Please check the beginning page of the unit guide for the consulting hours.

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Demonstrate active self-learning, critical thinking, problem-solving, technical report writing and time-management - individually and in a team.
- Design, simulate, implement, test and debug electronic circuits and systems

Assessment task

- Laboratory

Learning and teaching activity

- Develop skills based competencies in experimentation with overlap/application to theory and simulation. A significant portion of the laboratory effort is expected to be an exploration of the posed problem and of operation and setting up of equipment. Laboratory worksheets are provided to guide student work and will be available on iLearn at least 1 week prior to each laboratory session.

Changes from Previous Offering

The following changes from the previous offering have been made:

- New academic team of lecturers delivering the unit.
- Most of the theory learning contents are provided as online resources.
- In-class tests (weighed 20%) have been removed and take-home assignments (weighted 20%) are introduced in its place.
- Assessment weighting of Lab activities decreased from 35% to 30%
- A mini-exam (closed book classroom exam, weighted 5%) is introduced towards the end of the semester.
- Schedule and lecture slides have been updated and streamlined