



# ELEC676

## Electronics Devices and Systems

S2 Day 2015

*Dept of Engineering*

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## General Information

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Credit points

4

Prerequisites

Admission to MEng

Corequisites

Co-badged status

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:

Apply transfer characteristics and models of nonlinear devices in large-signal circuits.

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

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

Ability to analyse the operation of mixers and frequency convertors in the power and frequency domains.

Ability to analyse the operation of power amplifiers in the power and frequency domains.

Demonstrate self-learning, time-management, and project management, individually and

in a group setting

## General Assessment Information

This unit is delivered in four modules and a supporting practical class corresponding to the learning outcomes respectively. Each module will be graded against all four assessment tasks.

In order to pass this unit, students must perform satisfactorily in **ALL FOUR** assessment tasks listed above.

**Logging and Participation** will be assessed during scheduled classes, tutorials or laboratories. Grading will take into consideration the level of participation as evidenced by information recorded in a daily log or journal, attendance, and demeanour in the classes. Attendance at all scheduled classes is compulsory.

**Assignments** problems will be set to develop learning outcomes. There will be four assignments corresponding to four lecture blocks of three to four weeks. Grading will take into consideration the level of understanding demonstrated as evidenced by approach taken to present each solution.

*Assignment Problems* will be posted on iLearn at least two weeks before their submission date. *Assignment solutions* will be posted within three days after the submission date. Submissions will not be accepted once the solution is posted.

**Laboratory Reports** are to be submitted within five days of the end of each three-week laboratory block. Grading will take into consideration the level of discovery as evidenced by insight presented in the report in terms of critical evaluation of the laboratory activity and technical justification of procedure and design.

All assignments and reports **must be** submitted electronically through iLearn (in pdf format). Submissions are expected to be typed set in a logical layout and sequence. Markers WILL NOT grade poorly organized or illegible scans or drafts. The expected workload includes preparation of final copies and clear diagrams.

**Late submissions** or **absences** from tests and laboratories will not be accepted without *prior arrangement made at least one week* before the submission date. Extenuating circumstances will be considered upon lodgment of a formal notice of disruption of studies.

Closed-book **tests** of thirty minute duration will be conducted in a class following the submission of each assignment. The tests will examine understanding of the assignment concepts. Two weeks notice of the test date and time will be posted on iLearn.

A final closed-book **examination** of three hours will be conducted during the formal examination period.

## Assessment Tasks

Name	Weighting	Due
<a href="#">Logging</a>	10%	09/12/2015
<a href="#">Assignments</a>	20%	09/12/2015
<a href="#">Laboratory reports</a>	20%	09/12/2015
<a href="#">Tests and Final Examination</a>	50%	TBA

### Logging

Due: **09/12/2015**

Weighting: **10%**

Recording of information in a daily log or journal, attendance, and active participation in the classes.

On successful completion you will be able to:

- Demonstrate self-learning, time-management, and project management, individually and in a group setting

### Assignments

Due: **09/12/2015**

Weighting: **20%**

Written solutions to problems related to each lecture module, normally on a three to four-weekly basis.

On successful completion you will be able to:

- Apply transfer characteristics and models of nonlinear devices in large-signal circuits.
- Apply nonlinear device concepts to the design and analysis of advanced transistor amplifiers.
- Ability to apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Ability to analyse the operation of mixers and frequency convertors in the power and frequency domains.
- Ability to analyse the operation of power amplifiers in the power and frequency domains.

## Laboratory reports

Due: **09/12/2015**

Weighting: **20%**

Laboratories will be given to build up skills in several areas, including but not limited to, the use of simulation tools and circuit design, and the assembly and testing of prototypes to demonstrate the various phenomena studied in lecture.

On successful completion you will be able to:

- Apply transfer characteristics and models of nonlinear devices in large-signal circuits.
- Apply nonlinear device concepts to the design and analysis of advanced transistor amplifiers.
- Ability to apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Ability to analyse the operation of mixers and frequency convertors in the power and frequency domains.
- Ability to analyse the operation of power amplifiers in the power and frequency domains.
- Demonstrate self-learning, time-management, and project management, individually and in a group setting

## Tests and Final Examination

Due: **TBA**

Weighting: **50%**

A short in-class closed-book test will be conducted in the week following each assignment submission to examine understanding of the concepts developed in the assignment. (10% overall)

A final three-hour closed book examination will be conducted in the formal examination period to test competency and understanding of the learning outcomes. (40% overall)

On successful completion you will be able to:

- Apply transfer characteristics and models of nonlinear devices in large-signal circuits.
- Apply nonlinear device concepts to the design and analysis of advanced transistor amplifiers.
- Ability to apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Ability to analyse the operation of mixers and frequency convertors in the power and frequency domains.

- Ability to analyse the operation of power amplifiers in the power and frequency domains.

## Delivery and Resources

### Recommended texts:

Coleman, "An Introduction to Radio Frequency Engineering," Cambridge University Press 2004.

Sedra & Smith, "Microelectronic Circuits," Cambridge University Press.

### Technology used:

Typical electronic and electrical instruments such as voltage and current sources, voltmeters, ammeters, oscilloscopes, simulation software such as AWR Microwave Office, ORCAD, PSpice, and typesetting software such as Latex 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.

### Assignment Submissions and Reporting:

Submission of assignments and reports will be electronic to iLearn. Students will need to arrange access to computer tools to prepare and submit these.

## Unit Schedule

The unit is composed of four modules.

The first module will run for two to three weeks to deliver the basics of concepts required for effective comprehension of the remaining core modules.

The subsequent three modules will run for four weeks each and be directly linked to the learning outcomes. Each module will include lectures, laboratory and tutorial sessions, will be graded against all four assessment tasks listed above.

A detailed schedule will be posted on iLearn.

## Learning and Teaching Activities

### Directed self study

Resources and links posted on iLearn are expected to be reviewed and studied by all students.

## Lectures

Delivery of material not previously seen by the students or material which will be presented in a different context from information provided for directed self study. It will be assumed that information linked in iLearn is studied prior to the lecture. There may be some review material, but this is minimal

## 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 exploration of the posed problem and of operation and setting up of equipment.

## Tutorial Workshop

This activity develops the understanding of key concepts through problem based activities and discussion. Interaction, examples, and review is anticipated.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of 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/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Results

Results shown in *iLearn*, 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](http://ask.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](http://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](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use 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

- Apply transfer characteristics and models of nonlinear devices in large-signal circuits.
- Apply nonlinear device concepts to the design and analysis of advanced transistor amplifiers.
- Ability to apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.



- Ability to analyse the operation of mixers and frequency convertors in the power and frequency domains.
- Ability to analyse the operation of power amplifiers in the power and frequency domains.

## **Assessment tasks**

- Logging
- Laboratory reports

## **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 outcome**

- Demonstrate self-learning, time-management, and project management, individually and in a group setting

### **Assessment task**

- Logging

## **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 self-learning, time-management, and project management, individually and in a group setting

## **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**

- Apply transfer characteristics and models of nonlinear devices in large-signal circuits.
- Apply nonlinear device concepts to the design and analysis of advanced transistor amplifiers.
- Ability to apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Ability to analyse the operation of mixers and frequency convertors in the power and frequency domains.
- Ability to analyse the operation of power amplifiers in the power and frequency domains.

## **Assessment tasks**

- Laboratory reports
- Tests and Final Examination

## **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**

- Apply transfer characteristics and models of nonlinear devices in large-signal circuits.
- Apply nonlinear device concepts to the design and analysis of advanced transistor amplifiers.
- Ability to apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Ability to analyse the operation of mixers and frequency convertors in the power and frequency domains.
- Ability to analyse the operation of power amplifiers in the power and frequency domains.

## **Assessment tasks**

- Assignments
- Laboratory reports

- Tests and Final Examination

## 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

- Apply transfer characteristics and models of nonlinear devices in large-signal circuits.
- Apply nonlinear device concepts to the design and analysis of advanced transistor amplifiers.
- Ability to apply mathematical methods to the analysis of nonlinear electronic systems in the frequency domain.
- Ability to analyse the operation of mixers and frequency converters in the power and frequency domains.
- Ability to analyse the operation of power amplifiers in the power and frequency domains.

### Assessment tasks

- Logging
- Assignments
- Laboratory reports

## 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 outcome

- Demonstrate self-learning, time-management, and project management, individually and in a group setting

### Assessment tasks

- Logging
- Laboratory reports

## Changes from Previous Offering

Post test assignments are introduced in this offering.

The first module is reduced to one or two weeks in response to changing level of coverage of the related concepts in ELEC275.