# ELEC275

## Nonlinear Circuits and Devices

S2 Day 2015

*Dept of Engineering*

## Contents

# General Information

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Credit points
3

Prerequisites
(ELEC270(P) or ENGG270(P) or ELEC290(P)) and (MATH136(P) or MATH133(P))

Corequisites

Co-badged status

Unit description
This unit considers frequency dependence and active circuit elements. It develops the concepts of time-domain versus frequency-domain analysis, and Bode plots. For active elements, the unit introduces diodes and transistors, analysis of amplifier circuits, operational-amplifier-based active filters, and oscillators.

## 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:

Be proficient in analysing frequency-dependent circuits

Apply circuit-equivalent techniques to analyse amplifiers and transformers

Apply techniques to analyse simple circuits with nonlinear elements

Understand and analyse simple switching and large-signal circuits

Apply self learning and time management effectively in practical and reporting tasks

# General Assessment Information

In order to pass this unit, students must demonstrate:

1. Satisfactory achievement of all learning outcomes
2. Satisfactory performance in in-class tests and the final exam
3. Satisfactory performance overall

Late submissions or absences from tests, laboratories, assignments and reports will not be accepted without a formal notice of disruption of studies and its approval.

# Assessment Tasks

| Name | Weighting | Due |
|---|---|---|
| Laboratory Participation | 15% | Weekly (see iLearn) |
| Laboratory Reports | 10% | Four-weekly (see iLearn) |
| Assignments | 15% | Four-weekly (see iLearn) |
| In-Class Tests | 10% | Four-weekly (see iLearn) |
| Exam | 50% | Will appear in exam calendar |

## Laboratory Participation

Due: **Weekly (see iLearn)**
Weighting: **15%**

Weekly laboratory sessions start in Week 2 and finish in Week 13. They are compulsory for all students. Students are expected to arrive on time and use the laboratory time efficiently. Students cannot switch their weekly sessions without a formal notice of disruption of studies and its approval ahead of time.

All laboratory sessions are based on learning outcomes and students are required to review the concepts introduced in lectures before coming to each session. Laboratory 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.

Each student must keep time-stamped laboratory notes either electronically or using a bound paper notebook (see iLearn for more details). All preliminary work should be similarly recorded.

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.

On successful completion you will be able to:

- Be proficient in analysing frequency-dependent circuits
- Apply circuit-equivalent techniques to analyse amplifiers and transformers
- Apply techniques to analyse simple circuits with nonlinear elements
- Understand and analyse simple switching and large-signal circuits
- Apply self learning and time management effectively in practical and reporting tasks

## Laboratory Reports

Due: **Four-weekly (see iLearn)**
Weighting: **10%**

Students will prepare individual and original Laboratory Reports summarising their practical work. All reports will be submitted electronically through iLearn and their originality will be tested by Turnitin. All reports will follow the IEEE format specified on iLearn.

On successful completion you will be able to:

- Be proficient in analysing frequency-dependent circuits
- Apply circuit-equivalent techniques to analyse amplifiers and transformers
- Apply techniques to analyse simple circuits with nonlinear elements
- Understand and analyse simple switching and large-signal circuits
- Apply self learning and time management effectively in practical and reporting tasks

## Assignments

Due: **Four-weekly (see iLearn)**
Weighting: **15%**

Take-home assignments will be based on the key concepts being introduced at each learning-outcome-module. Assignment questions will be posted on iLearn at the beginning of each module. Solutions may be hand-written but electronically submitted (check iLearn). All assignments should be prepared individually. It is expected that students consult staff or other students while learning the concepts, but copying assignments from others is not acceptable.

On successful completion you will be able to:

- Be proficient in analysing frequency-dependent circuits
- Apply circuit-equivalent techniques to analyse amplifiers and transformers
- Apply techniques to analyse simple circuits with nonlinear elements
- Understand and analyse simple switching and large-signal circuits

## In-Class Tests

Due: **Four-weekly (see iLearn)**
Weighting: **10%**

After the submission of each take-home assignment there will be a individual short test during the lecture (see iLearn for exact dates) on the topics of the assignment.

On successful completion you will be able to:

- Be proficient in analysing frequency-dependent circuits
- Apply circuit-equivalent techniques to analyse amplifiers and transformers
- Apply techniques to analyse simple circuits with nonlinear elements
- Understand and analyse simple switching and large-signal circuits

## Exam

Due: **Will appear in exam calendar**
Weighting: **50%**

A closed-book 3-hour examination will be conducted in the formal examination period.

On successful completion you will be able to:

- Be proficient in analysing frequency-dependent circuits
- Apply circuit-equivalent techniques to analyse amplifiers and transformers
- Apply techniques to analyse simple circuits with nonlinear elements
- Understand and analyse simple switching and large-signal circuits

# Delivery and Resources

Text Books:

1. Svoboda & Dorf "Introduction to Electric Circuits", Wiley, 9th or 8th Editions, electronic or printed versions.
2. Sedra/Smith "Microelectronic Circuits", Oxford University Press, International Sixth Edition

Required unit materials:

- Text book

- Calculator for exam, tests and laboratory sessions

Technology used:

Practical use of electronic equipment such as oscilloscopes, spectrum analysers, ac and dc sources will be employed during laboratory sessions. Soldering of electronic components will be introduced. Students will construct and measure practical circuits relevant to the learning outcomes.

New circuit simulation software (AWR Microwave Office) will be introduced for steady-state frequency-domain analysis. Other software already familiar to students such as MATLAB, and typesetting software such as Latex may be used.

# Unit Schedule

The unit will be organised in four modules that are directly linked with the learning outcomes. A detailed weekly schedule will be posted on iLearn.

# 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

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

Disruption to Studies Policy 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/

## 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.

## 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

## 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

## 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

- Be proficient in analysing frequency-dependent circuits
- Apply circuit-equivalent techniques to analyse amplifiers and transformers

- Apply techniques to analyse simple circuits with nonlinear elements
- Understand and analyse simple switching and large-signal circuits

## Assessment tasks

- Laboratory Participation
- Laboratory Reports
- Assignments
- In-Class Tests
- Exam

# 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

- Be proficient in analysing frequency-dependent circuits
- Apply circuit-equivalent techniques to analyse amplifiers and transformers
- Apply techniques to analyse simple circuits with nonlinear elements
- Understand and analyse simple switching and large-signal circuits

## Assessment tasks

- Assignments
- In-Class Tests
- Exam

# 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 outcome

- Apply self learning and time management effectively in practical and reporting tasks

### Assessment tasks

- Laboratory Participation
- Assignments

## 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

- Apply self learning and time management effectively in practical and reporting tasks

### Assessment tasks

- Laboratory Participation
- Laboratory Reports

# Changes from Previous Offering

Weekly plan and modules are slightly modified from last year to accommodate the changes in the prerequisite unit ENGG270 and to improve the transition to higher level units such as ELEC376.