ELEC275

Nonlinear Circuits and Devices

S2 Day 2014

Dept of Engineering

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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:

Extract ac circuit equivalents of two-port networks to determine power transfer

Apply trans-dependence concept to model amplifiers and transformers

Apply dynamic-resistance concept to nonlinear elements to simplify their large-signal models into linear small-signal models

Use correct engineering techniques in measurements, circuit construction, analysis and reporting

General Assessment Information

Students need to get a pass mark on each of the assessment tasks to pass the unit.

Assessment Tasks

Name	Weighting	Due
Laboratory participation	15%	Weekly (see iLearn)
Laboratory reports	15%	Four-weekly (see iLearn)
Assignments	20%	Two-weekly (see iLearn)
Exam	50%	Will appear in exam calendar

Laboratory participation

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

Laboratory sessions start in Week 2. They are compulsory for all students. There will be both practical sessions and tutorials. All laboratory sessions are based on learning outcomes and students are required to review the concepts introduced in lectures before coming to each laboratory session. They will be given a quiz before the laboratory session to test their level of preparation.

Each student must have one bound notebook to be used as a laboratory/tutorial log (A4 size preferred, graph pages are not required). This logbook should also be used for any preliminary work. It should contain dates, calculations and results recorded during these sessions and student's comments in time order. On the completion of each session, logbook entries must be signed and dated by a tutor. At the end of the semester the logbooks will be collected for final marking.

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:

- Extract ac circuit equivalents of two-port networks to determine power transfer
- Apply trans-dependence concept to model amplifiers and transformers

- Apply dynamic-resistance concept to nonlinear elements to simplify their large-signal models into linear small-signal models
- Use correct engineering techniques in measurements, circuit construction, analysis and reporting

Laboratory reports

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

Students will prepare individual laboratory reports summarising their practical work. A typical engineering-journal format will be used. There will be 3 reports, one for each learning-outcome module. Reports will be submitted electronically through iLearn.

On successful completion you will be able to:

- Use correct engineering techniques in measurements, circuit construction, analysis and reporting

Assignments

Due: **Two-weekly (see iLearn)**
Weighting: **20%**

Assignments will be based on the key concepts being introduced at each learning-outcome-module (two assignments for each module). Assignment questions will be posted on iLearn one week before their due date. Submissions will be hand-written or electronic (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:

- Extract ac circuit equivalents of two-port networks to determine power transfer
- Apply trans-dependence concept to model amplifiers and transformers
- Apply dynamic-resistance concept to nonlinear elements to simplify their large-signal models into linear small-signal models

Exam

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

The final exam will be closed-book and 3 hours. A formula sheet will be provided if necessary

On successful completion you will be able to:

- Extract ac circuit equivalents of two-port networks to determine power transfer

- Apply trans-dependence concept to model amplifiers and transformers
- Apply dynamic-resistance concept to nonlinear elements to simplify their large-signal models into linear small-signal models

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
- Lecture notes and notes for practical sessions (available from iLearn)
- Bound logbook for all practical 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 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 is composed of three modules. Each module will run for four weeks and be directly linked to the learning outcomes. Each module will include weekly lectures, weekly laboratory sessions, two assignments and one laboratory report.

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/

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

- Extract ac circuit equivalents of two-port networks to determine power transfer
- Apply trans-dependence concept to model amplifiers and transformers
- Apply dynamic-resistance concept to nonlinear elements to simplify their large-signal models into linear small-signal models
- Use correct engineering techniques in measurements, circuit construction, analysis and reporting

Assessment tasks

- Laboratory participation
- Laboratory reports
- 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

- Extract ac circuit equivalents of two-port networks to determine power transfer
- Apply trans-dependence concept to model amplifiers and transformers
- Apply dynamic-resistance concept to nonlinear elements to simplify their large-signal models into linear small-signal models
- Use correct engineering techniques in measurements, circuit construction, analysis and

reporting

Assessment tasks

- Assignments
- 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

- Use correct engineering techniques in measurements, circuit construction, analysis and reporting

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

- Use correct engineering techniques in measurements, circuit construction, analysis and reporting

Assessment tasks

- Laboratory participation
- Laboratory reports

Changes from Previous Offering

A new module structure is introduced where each four-week module is directly linked to one learning outcome. See iLearn for details of the new modules.