ELEC476

Advanced Electronics Engineering

S1 Day 2015

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
ELEC376(P)

Corequisites

Co-badged status

Unit description
This unit integrates prior learning in a specialist area of engineering with problem solving, emerging technology and aspects of engineering application, technical reporting and self-management to prepare students to work at a professional capacity. The unit aims to address the application of fundamental principles and methods at an advanced level in the context of standards and practices, modelling, analysis, design and practical implementation. The unit also develops skills in the critical evaluation of information, software and sources of error and experimental methods. Learning will be achieved using case studies, laboratories, presentations, group work and traditional lecture format. The specific topics will focus on current advances in the area including advanced electronics systems such as PLLs, oscillators, analogue-to-digital conversion, power conversion and control, IC design, radio circuits and systems, RF measurements, and CAD.

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:

Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.

Ability to apply mathematical methods to the analysis of advanced electronic circuits.

Ability to design advanced circuits and systems using advanced EDA simulation tools.

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

General Assessment Information

This unit is delivery in three modules (design trade-offs between linearity and noise, amplifier designs and electromagnetic simulations) and supporting practical sessions 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 FIVE assessment tasks listed below.

Assignments are to be submitted before the deadline. Grading will take into consideration the level of discovery as evidenced by insight presented in the report in terms of critical evolution of the laboratory activity and technical justification of procedure and design.

Practical will be assessed during scheduled laboratories. Grading will take into consideration the level of participation as evidenced by the simulated results and attendance in the classes.

Logging will be assessed at the end of each laboratory session. Grading will take into consideration the level of participation as evidenced by information recorded in a logbook.

Closed-book tests of thirty minutes duration will be conducted in a class as scheduled. The tests will examine understanding of the concepts developed in lecture.

A final two-hour closed-book examination will be conducted during the formal examination period.

Note: 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.

Assessment Tasks

Name	Weighting	Hurdle	Due
System Specifications	5%	No	09/03/2015
Low-noise amplifiers design	5%	No	20/04/2015
Driver amplifiers design	5%	No	04/05/2015
Balun design	5%	No	25/05/2014
Laboratories	20%	No	TBA
Laboratory Logbook	10%	No	29/05/2014

Name	Weighting	Hurdle	Due
In-class tests	20%	No	Week 9 and 13
Final examination	30%	No	TBD

System Specifications

Due: **09/03/2015**
Weighting: **5%**

The aim of this project is to understand the design trade-off between noise figure (NF) and linearity. In this project, you will be asked to investigate the design trade-offs between linearity and NF from the system-level. Based on your investigations, you will be asked to provide an individual technical report that covers the relevant simulation results and design trade-offs.

On successful completion you will be able to:

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Low-noise amplifiers design

Due: **20/04/2015**
Weighting: **5%**

The aim of this project is to learn how to design low-noise amplifiers (LNAs) using process design kit (PDK). In this project, you will be asked to design a common-source LNA and a common-gate LNA. Based on your designs, you will be asked to provide an individual technical report that covers the design trade-offs and relevant simulation results, such as NF, linearity, power gain and stability.

On successful completion you will be able to:

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Driver amplifiers design

Due: **04/05/2015**
Weighting: **5%**

The aim of this project is to design driver amplifiers using PDK. In this project, you will be asked to design a common-drain amplifier. Based on your design, you will be asked to provide an

individual technical report that covers the design trade-offs and the relevant simulation results, such as linearity, power consumption and gain/loss.

On successful completion you will be able to:

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Balun design

Due: **25/05/2014**
Weighting: **5%**

The aim of this project is to investigate the Balun designs using PDK. In this project, you will be asked to design an active balun and a passive balun. Based on your designs, you will be asked to provide an individual technical report that covers the design trade-offs and the relevant simulation results, such as, gain/loss, gain error and phase error.

On successful completion you will be able to:

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Laboratories

Due: **TBA**
Weighting: **20%**

There are ten sessions are assigned for this unit. The aims of this assessment is to design different amplifiers and understand the design trade-offs for each design.

On successful completion you will be able to:

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

Laboratory Logbook

Due: **29/05/2014**
Weighting: **10%**

The discussion and meeting minutes need to be recorded on your logbook. At the end of this semester, you will be asked to submit your logbook.

On successful completion you will be able to:

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Demonstrate self-learning and project management skills, individually and in a group setting.

In-class tests

Due: **Week 9 and 13**
Weighting: **20%**

Two 30-minute in-class closed-book tests will be given in Week 9 and Week 13, to examine understanding of the concepts developed in lecture. (20% overall)

On successful completion you will be able to:

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Demonstrate self-learning and project management skills, individually and in a group setting.

Final examination

Due: **TBD**
Weighting: **30%**

A final two-hour closed-book examination will be conducted in the formal examination period to test competency and understanding of the learning outcomes.

On successful completion you will be able to:

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.

Delivery and Resources

Grades and final mark

Satisfactory completion of overall components is mandatory to obtain a pass (or a better) grade.

What is required to complete the unit satisfactorily

Pass mark in each assessment component.

Assessment Tasks

There will be one, semester long project combining group and individual work. You will form a multi-disciplinary design with students in ELEC446. Deliverables for the design project are described below in the assessment summary. All assignments should be submitted via iLearn unless special arrangements are made with the unit convenor.

Practical sessions

In weeks specified in the schedule, there will be practical sessions in this unit. You must keep a bound laboratory book in which you should record your groupwork notes, calculations, experiments, simulations and results. For each laboratory topic you should produce a practical report which incorporates theory, measurement, and simulation and in a format generally acceptable in engineering. All reports are due immediately prior to the next week's practical session, even if there is no practical that week. All reports should be submitted via iLearn unless special arrangements are made with the unit convenor.

Extension requests

Must be supported by evidence of medical conditions or misadventure.

Examination conditions

2-hour, formal examination

Supplementary examination

Applications for a supplementary examination (based on medical reasons or misadventure) will only be considered if students have gained passes in pre-examination assessments.

Text book

Recommended: Coleman, "An Introduction to Radio Frequency Engineering," Cambridge University Press 2004. Sedra & Smith, "Microelectronic Circuits," Cambridge University Press. Weste and Harris, "CMOS VLSI Design", Addison Wesley, 3rd edition (2004), or 4th edition, 2011.

Reference book(s)

A series of engineering journal references will be provided during lectures, which are expected to be sourced through the library

Notes

Lecture and tutorial notes will be provided as required.

Software

Extensive use of AWR's Analog Office software will be made during the semester. It would be advisable for you to register on their website as students. See the unit convenor for a license for your Windows PC.

Required unit materials and/or recommended readings

TBA

Changes since the last offering of this unit

This unit has been modified to formally incorporate aspects of engineering practice. This includes laboratory logging and professional conduct.

Technologies used and required

Various hardware and software tools for analysis, simulation and testing and experimentation of communication systems are used for this unit.

Unit Schedule

TBA

Learning and Teaching Activities

Self study

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

Lecture

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 on iLearn is studied prior to the lecture. There may be some review material, but this is minimal.

Laboratoty

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.

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

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

- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Assessment tasks

- Low-noise amplifiers design
- Driver amplifiers design
- Balun design

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

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.
- Demonstrate self-learning and project management skills, individually and in a group setting.

Assessment task

- System Specifications

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 outcomes

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.
- Demonstrate self-learning and project management skills, individually and in a group setting.

Assessment tasks

- System Specifications
- Laboratories

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 of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Assessment tasks

- System Specifications
- Low-noise amplifiers design
- Driver amplifiers design
- Balun design
- In-class tests

- 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

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Assessment tasks

- System Specifications
- Low-noise amplifiers design
- Driver amplifiers design
- Balun design
- In-class tests
- 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

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to design advanced circuits and systems using advanced EDA simulation tools.

Assessment tasks

- System Specifications

- Low-noise amplifiers design
- Driver amplifiers design
- Balun design
- In-class tests

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

- Ability to design advanced circuits and systems using advanced EDA simulation tools.
- Demonstrate self-learning and project management skills, individually and in a group setting.

Assessment tasks

- System Specifications
- Low-noise amplifiers design
- Driver amplifiers design
- Balun design
- Laboratories

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Demonstrate self-learning and project management skills, individually and in a group setting.

Assessment tasks

- System Specifications
- Laboratories
- Laboratory Logbook

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Understand of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuits and systems design.
- Demonstrate self-learning and project management skills, individually and in a group setting.

Assessment tasks

- System Specifications
- Laboratories
- Laboratory Logbook

Changes from Previous Offering

Two in-class tests and final t-hour examination are introduced in this offering.