# ELEC476

## Advanced Electronics Engineering

S1 Day 2014

*Dept of Engineering*

## Contents

# General Information

Unit convenor and teaching staff
Unit Convenor
Forest Zhu
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Credit points
3

Prerequisites
ELEC376(P)

Corequisites

Co-badged status
Co-taught with ELEC446, but not co-badged

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:

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

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

Ability to conduct laboratory experiments using advanced measurement and simulation tools.

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

# Assessment Tasks

| Name | Weighting | Due |
|---|---|---|
| Design Project 1 | 5% | 24/03/2014 |
| Design Project 2 | 20% | 05/05/2014 |
| Design Project 3 | 40% | 02/06/2014 |
| Design Project 4 | 10% | 10/06/2014 |
| Laboratories | 20% | TBA |
| Laboratory Logbook | 5% | 29/05/2014 |

## Design Project 1

Due: **24/03/2014**
Weighting: **5%**

It is a group work. The functional specifications of each building block need to be decided in this project so that the detailed transistor level circuits can be implemented.

On successful completion you will be able to:

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

## Design Project 2

Due: **05/05/2014**
Weighting: **20%**

This is an individual work. Based on the previously generated functional specifications, an initial design of assigned building block needs to be simulated. Then, the simulated results need to be compared with the other state-of-the-art design presented in the literature.

On successful completion you will be able to:

- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Demonstrate self-learning, time-management, and project management, individually and in a group setting

## Design Project 3

Due: **02/06/2014**
Weighting: **40%**

This is an individual work. Based on the specifications and circuits developed in the first and the second projects, the previously developed building block needs to be optimized at the schematic level. Moreover, the layout of the designed circuit as well as post-layout extraction needs to be finalized.

On successful completion you will be able to:

- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Demonstrate self-learning, time-management, and project management, individually and in a group setting

## Design Project 4

Due: **10/06/2014**
Weighting: **10%**

It is a group work. Based on the results generated from the previous design projects, a presentation needs to be given at this project. In the presentation, you should clearly descript the trade-off between different design aspects from a system design point of view. Moreover, each person within the group needs to briefly descript the trade-off between different design aspects from a circuit design point of view.

On successful completion you will be able to:

- Ability to conduct laboratory experiments using advanced measurement and simulation tools.
- Demonstrate self-learning, time-management, and project management, individually and in a group setting

## Laboratories

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

There are four laboratory sessions are assigned for this unit.

On successful completion you will be able to:

- Understanding of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuit and systems design.
- Ability to conduct laboratory experiments using advanced measurement and simulation tools.

## Laboratory Logbook

Due: **29/05/2014**
Weighting: **5%**

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:

- Understanding of the advanced concepts in electronic device and element operation, characterisation of performance, advance circuit 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 all assessable 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 AND a pass mark in the final examination

## 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

1-hour, open book/notes

## 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

| | Lecture | Practical | Assignment |
|---|---|---|---|
| 3-Mar. | Introduction/system design | | |
| 10-Mar. | System design | Partitioning | |
| 17-Mar. | Design flow and implementation | System design | |
| 24-Mar. | CMOS technology | Open practical time | Functional specifications |
| 31-Mar. | Schematic entry | Open practical time | |
| 7-Apr. | CMOS layout | Open practical time | |
| 14-Apr. | CMOS extraction | CMOS layout | |
| 21-Apr. | Easter break | | |
| 28-Apr. | Easter break | | |
| 5-May. | CMOS verification | Open practical time | Initial design |
| 12-May. | Open topics | Open practical time | |
| 19-May. | Open topics | Open practical time | |
| 26-May. | Open topics | Open practical time | Examination |
| 2-Jun. | Open topics | Open practical time | Final report |
| 10-Jun. | Presentation | | Presentation |
| | | | |

# 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

## 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

- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to conduct laboratory experiments using advanced measurement and simulation tools.
- Demonstrate self-learning, time-management, and project management, individually and in a group setting

### Assessment tasks

- Design Project 1
- Design Project 3
- Design Project 4

## 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

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

### Assessment tasks

- Design Project 2
- Design Project 3
- 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

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

### Assessment tasks

- Design Project 1
- Design Project 2
- Design Project 3
- Design Project 4
- Laboratories

## 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

- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to conduct laboratory experiments using advanced measurement and simulation tools.

### Assessment tasks

- Design Project 1
- Design Project 3
- Laboratory Logbook

## 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

- Ability to apply mathematical methods to the analysis of advanced electronic circuits.
- Ability to conduct laboratory experiments using advanced measurement and simulation tools.

### Assessment tasks

- Design Project 1
- Design Project 2
- Design Project 3
- Laboratories
- Laboratory Logbook

## 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 conduct laboratory experiments using advanced measurement and simulation tools.

### Assessment tasks

- Design Project 2
- Design Project 3

## 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

- Design Project 1
- Design Project 4

## 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

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

### Assessment tasks

- Design Project 1
- Design Project 4

## 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

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

## Assessment tasks

- Design Project 1
- Design Project 4