# ELEC3076

## Electronic Devices and Systems

Session 2, In person-scheduled-weekday, North Ryde 2022

*School of Engineering*

## Contents

# General Information

Unit convenor and teaching staff
Unit Convenor, Lecturer
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Credit points
10

Prerequisites
((ELEC2005 or ELEC2075 or ELEC275) and completion of 130cp) or admission to MEngElecEng

Corequisites

Co-badged status

Unit description
This unit builds on linear and nonlinear circuit design, and further develops the topics of analogue circuit theory and practice with an emphasis on the circuit and system design. It covers semiconductor devices, circuit simulations, transistor amplifiers, operational-amplifiers, mixers and power amplifiers. It will also deal with advanced topics which may include noise and non-linear design issues. Students will get hands-on experience in designing and building small signal amplifiers, power amplifiers and mixers as well as working with professional software packages for circuit design and analysis.

## 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:

**ULO1:** explain basic semiconductor devices, their operation and non-linear behaviour

**ULO2:** apply nonlinear device concepts to design and analyse transistor amplifiers

**ULO3:** apply mathematical methods to analyse nonlinear electronic systems in the frequency domain

**ULO4:** analyse the operation of power amplifiers in the time and frequency domains

**ULO5:** design, simulate, implement, test and debug electronic circuits and systems

**ULO6:** demonstrate active self-learning, critical thinking, problem-solving, technical writing and time-management skills, individually and in a team.

# General Assessment Information

**Late Assessment Submission Penalty**

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following university standard late penalty applied. Please see https://students.mq.edu.au/study/assessment-exams/assessments for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at **11:55 pm**. A 1-hour grace period is provided to students who experience a technical concern.

For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, students need to submit an application for Special Consideration.

**Assessments where Late Submissions will be accepted**

In this unit, late submissions will be accepted as follows:

- Take-home assignment - YES, standard late penalty applies.
- Laboratory - NO, unless special consideration is granted.
- Pre-classroom online quiz - NO, unless special consideration is granted.

# Assessment Tasks

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| Take-home assignment | 20% | No | Week 4,7,9,11 |
| Class test | 5% | No | Week 12 |

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| Laboratory | 25% | No | Weekly |
| Final examination | 40% | No | TBA |
| Pre-classroom online quiz | 10% | No | Weekly |

## Take-home assignment

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 8 hours
Due: **Week 4,7,9,11**
Weighting: **20%**

Take-home assignments mainly consist of numerical problems on the concepts learned. The answers are to be submitted online via iLearn. There will be four assignments in total.

On successful completion you will be able to:

- explain basic semiconductor devices, their operation and non-linear behaviour
- apply nonlinear device concepts to design and analyse transistor amplifiers
- apply mathematical methods to analyse nonlinear electronic systems in the frequency domain
- analyse the operation of power amplifiers in the time and frequency domains
- demonstrate active self-learning, critical thinking, problem-solving, technical writing and time-management skills, individually and in a team.

## Class test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 1 hours
Due: **Week 12**
Weighting: **5%**

This is a one-hour open-book test conducted during a regular lecture/laboratory session. There will be only one class test in total.

On successful completion you will be able to:

- explain basic semiconductor devices, their operation and non-linear behaviour
- apply nonlinear device concepts to design and analyse transistor amplifiers
- apply mathematical methods to analyse nonlinear electronic systems in the frequency domain
- analyse the operation of power amplifiers in the time and frequency domains

## Laboratory

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 8 hours
Due: **Weekly**
Weighting: **25%**

The experiments are designed to explore the practical aspects of theories discussed in the unit. There are four lab modules in total. Marks are awarded for pre-lab works, active participation in the lab, and the quantity and quality of demonstrated results.

On successful completion you will be able to:

- design, simulate, implement, test and debug electronic circuits and systems
- demonstrate active self-learning, critical thinking, problem-solving, technical writing and time-management skills, individually and in a team.

## Final examination

Assessment Type [1]: Examination
Indicative Time on Task [2]: 2 hours
Due: **TBA**
Weighting: **40%**

A final examination will be conducted during the formal examination period. This examination will assess all topics discussed in the unit unless otherwise specified.

On successful completion you will be able to:

- explain basic semiconductor devices, their operation and non-linear behaviour
- apply nonlinear device concepts to design and analyse transistor amplifiers
- apply mathematical methods to analyse nonlinear electronic systems in the frequency domain

- analyse the operation of power amplifiers in the time and frequency domains
- demonstrate active self-learning, critical thinking, problem-solving, technical writing and time-management skills, individually and in a team.

## Pre-classroom online quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Weekly**
Weighting: **10%**

Students are expected to go through the online learning content, understand the theory and attempt the online quiz each week before attending the classroom activities of that week.

On successful completion you will be able to:

- explain basic semiconductor devices, their operation and non-linear behaviour
- apply nonlinear device concepts to design and analyse transistor amplifiers
- apply mathematical methods to analyse nonlinear electronic systems in the frequency domain
- analyse the operation of power amplifiers in the time and frequency domains
- demonstrate active self-learning, critical thinking, problem-solving, technical writing and time-management skills, individually and in a team.

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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

# Delivery and Resources

**Recommended texts:**

Sedra and Smith- Microelectronic Circuits 6th Edition. The material will also cover other books and journal articles. Reading recommendations will be provided through iLearn.

**Technology used:**

Lectures+tutorials ( called lectorials) will be conducted online via Zoom. All the learning and

assessment resources will be made available on iLearn.

Typical electronic and electrical instruments such as voltage and current sources, voltmeters, ammeters, oscilloscopes and spectrum analysers will be used in the lab. For circuit simulation, LTSPICE software will be used.

You will need a logbook (a bound notebook only for this purpose and no loose sheets) for the lab.

You will need a calculator for various numerical exercises throughout the session. **Note that only calculators with no text-recall function are permitted for the final exam**.

# Unit Schedule

A detailed schedule is available on the iLearn page. Note that there will be **no laboratory session in week1.**

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

## Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) 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 or if you are a Global MBA student contact globalmba.support@mq.edu.au

## Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

## Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

### The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

## Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues

## Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

## IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

# Changes from Previous Offering

Learning content and context are updated. No major changes from the previous offering.

# EA Stage1 Competency Mapping

| EA Competency Standard | | Unit Learning Outcomes |
|---|---|---|
| Knowledge and Skill Base | 1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline. | ULO1, ULO2, ULO3, ULO4 |
| | 1.2 Conceptual understanding of underpinning maths, analysis, statistics, and computing. | ULO1, ULO2, ULO3, ULO4 |
| | 1.3 In-depth understanding of specialist bodies of knowledge | |
| | 1.4 Discernment of knowledge development and research directions | |
| | 1.5 Knowledge of engineering design practice | |
| | 1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice. | |
| Engineering Application Ability | 2.1 Application of established engineering methods to complex problem solving | ULO5, ULO6 |
| | 2.2 Fluent application of engineering techniques, tools and resources. | ULO5 |
| | 2.3 Application of systematic engineering synthesis and design processes. | ULO5 |
| | 2.4 Application of systematic approaches to the conduct and management of engineering projects. | |
| Professional and Personal Attributes | 3.1 Ethical conduct and professional accountability. | |
| | 3.2 Effective oral and written communication in professional and lay domains. | |
| | 3.3 Creative, innovative and pro-active demeanour. | |
| | 3.4 Professional use and management of information. | |

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|---|---|---|
| | 3.5 Orderly management of self, and professional conduct. | |
| | 3.6 Effective team membership and team leadership | |