ELEC2040

Signals and Systems

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Engineering

Contents

General Information

Unit convenor and teaching staff

Convenor
Stephen Hanly
stephen.hanly@mq.edu.au
Contact via email
44 Waterloo Road room 108
appointment via email

Lecturer
Iain Collings
iain.collings@mq.edu.au
Contact via email
44 Waterloo Road room 109
appointment via email

Tutorer
Erfan Khordad
erfan.khordad@hdr.mq.edu.au
Contact via email
appointment via email

Ali Lalbakhsh
ali.lalbakhsh@mq.edu.au

Credit points
10

Prerequisites
MATH1020 or MATH1025 or MATH133 or MATH136

Corequisites

Co-badged status

Unit description
The aim of this unit is to give students a comprehensive introduction to the theory of signal processing and analysis that is used in many areas of electronic and telecommunications engineering including: circuit analysis; amplifiers and electronic systems; analogue and digital communications; audio and image processing; and control systems. The unit covers time and frequency analysis for both continuous-time and discrete-time signals. Topics covered in the unit include: linear time-invariant systems; convolution; Fourier series; Fourier transforms; Laplace Transforms; Discrete Fourier transforms; and Z transforms.

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: solve signal processing problems involving complex numbers

ULO2: demonstrate how signals can be scaled in space, time, flipped in time (time-reversed), delayed (right and left shifted), and to compute other signal properties (mean, energy, power, periodicity).

ULO3: articulate well developed knowledge of the concept of a linear time-invariant system and the concept of the convolution of two signals.

ULO4: articulate the concept of signal domains: how the same signal can be represented in different domains (in time or in frequency) and how to transform from one representation to another.

ULO5: Illustrate the role of sampling and filtering in converting between continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.

ULO6: use Matlab to solve problems in Signals and Systems

General Assessment Information

Submission deadlines:

- Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.
- All other assessments must be submitted by 5:00 pm (Sydney Time) on their due date.
- Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration.

- Assessments not submitted by the due date will receive a mark of zero.

On campus activities:

The quiz, tests, and practicals classes will be held on campus at the scheduled times. Any student who cannot attend on campus should contact the convenor (Stephen Hanly) as soon as possible.

Hurdle Quiz: There will be a hurdle quiz in week 2 worth 3%. The quiz will be on basic introductory and prerequisite knowledge, which will have been reviewed in the first week of the unit. This quiz is a hurdle requirement for the unit. A grade of 60% or more in this quiz is a condition of passing this unit. If you are given a second opportunity to sit the quiz as a result of failing to meet the minimum mark required, you will be notified of the exact day and time of the second attempt. The second attempt at a hurdle assessment is graded as pass fail. The maximum grade for a second attempt is the hurdle threshold grade.

Tests: There will be four tests during the semester. The Tests have the following condition: If the mark is less than 50%, then the student will be given a second chance to achieve a mark of 50%, by completing extra assessment to a satisfactory standard. The extra assessment will be in the form of a take-home assignment, for which the student will need to achieve a mark of greater than 50%. If the assignment mark is not greater than 50%, then the original Test mark will stand. These tests will be available on ilearn at a specified time, and solutions must be uploaded to ilearn at a specified time.

Projects will be undertaken during each practical session scheduled in weeks 1-13, and will be submitted on-line on ilearn at times stated on the assignment on ilearn. There will be a practical session in week 1.

Final exam.

If you receive special consideration for the final exam, a supplementary exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal exam period. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

The final exam has a **hurdle requirement**. Students must obtain at least 40% on final exam to pass the unit. If you are given a second opportunity to sit the final examination as a result of failing to meet the minimum mark required, you will be offered that chance during the supplementary examination period and will be notified of the exact day and time after the publication of final results for the unit. The second attempt at a hurdle assessment is graded as pass fail. The maximum grade for a second attempt is the hurdle threshold grade.

Requirements to pass the unit:

In order to pass this unit a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD) and achieve all hurdle requirements.

Assessment Tasks

Name	Weighting	Hurdle	Due
Hurdle Quiz	3%	Yes	28/02/22
Projects	22%	No	Weeks 1-13
Test 1	5%	No	14/03/22
Test 2	5%	No	28/03/22
Test 3	5%	No	02/05/22
Test 4	5%	No	16/05/22
Final Exam	55%	Yes	TBA

Hurdle Quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **28/02/22**
Weighting: **3%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Quiz on pre-requisite knowledge in complex numbers

On successful completion you will be able to:

- solve signal processing problems involving complex numbers

Projects

Assessment Type [1]: Project
Indicative Time on Task [2]: 26 hours
Due: **Weeks 1-13**
Weighting: **22%**

Projects will be undertaken weekly after the practical classes. They will be done as homework and submitted on-line.

On successful completion you will be able to:

- use Matlab to solve problems in Signals and Systems

Test 1

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **14/03/22**
Weighting: **5%**

Test on signal operations and signal properties

On successful completion you will be able to:

- demonstrate how signals can be scaled in space, time, flipped in time (time-reversed), delayed (right and left shifted), and to compute other signal properties (mean, energy, power, periodicity).

Test 2

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **28/03/22**
Weighting: **5%**

Test on linear time invariant systems and convolution

On successful completion you will be able to:

- articulate well developed knowledge of the concept of a linear time-invariant system and the concept of the convolution of two signals.

Test 3

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **02/05/22**
Weighting: **5%**

Test on Fourier Transforms and Properties

On successful completion you will be able to:

- articulate the concept of signal domains: how the same signal can be represented in different domains (in time or in frequency) and how to transform from one representation to another.

Test 4

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **16/05/22**
Weighting: **5%**

Test on Laplace Transforms and Sampling

On successful completion you will be able to:

- Illustrate the role of sampling and filtering in converting between continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 2 hours
Due: **TBA**
Weighting: **55%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Final Exam

On successful completion you will be able to:

- solve signal processing problems involving complex numbers
- demonstrate how signals can be scaled in space, time, flipped in time (time-reversed), delayed (right and left shifted), and to compute other signal properties (mean, energy, power, periodicity).

- articulate well developed knowledge of the concept of a linear time-invariant system and the concept of the convolution of two signals.
- articulate the concept of signal domains: how the same signal can be represented in different domains (in time or in frequency) and how to transform from one representation to another.
- Illustrate the role of sampling and filtering in converting between continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.

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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

The main resources for the unit are the audio books and the short concept videos. The audio books are posted to ilearn, and the short concept videos are also linked in ilearn. The short concept videos can be found on youtube, searching for "Iain Explains Signals". The appropriate videos for each week are listed on ilearn.

Tests, problem sheets, practical sheets, and projects are all posted to ilearn.

There are many textbooks that provide comprehensive coverage of the material in this unit. We will be referring to the following two books as we progress through the unit:

“Signals and systems”, S. Haykin and B. Van Veen, John Wiley & Sons, second edition. 2003.

“Signals & Systems”, A. V. Oppenheim and A. S. Willsky with S. H. Nawab, Prentice-Hall, second edition, 1997.

These books are on closed reserve in the library.

Other books include:

“Signals, Systems and Transforms” 4th ed, by Phillips, Parr and Riskin. Pearson publishers. 2008.

“Signals and systems”, M. J. Roberts, McGraw-Hill.2004.

“An Introduction to Signals and Systems”, J. A. Stuller, Thomson publishers, 2008.

“Linear Systems and Signals”, 2nd ed, B. P. Lathi, Oxford University Press, 2005.

“Discrete-time signal processing”, A. V. Oppenheim and R. W. Schafer with J. R. Buck, Prentice-Hall, 1999.

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

No change from previous offerings.

Engineers Australia Competency Mapping

Knowledge and skill base:

1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline. **UL02, UL03, OL04**

1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing. **UL01-UL05**

1.3 In-depth understanding of specialist bodies of knowledge **UL02-UL05**

Engineering Application ability:

2.1 Application of established engineering methods to complex problem solving. **UL03-UL06**

2.2 Fluent application of engineering techniques, tools and resources. **UL04-UL06**

Changes since First Published

Date	Description
04/02/2022	The Final Exam was previously stated to be available on-line. This is not stated in the new version of the unit guide.