ELEC2040

Signals and Systems

Session 1, In person-scheduled-weekday, North Ryde 2025

School of Engineering

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General Information

Unit convenor and teaching staff
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Credit points
10

Prerequisites
MATH1020 or MATH1025

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.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals (UNSDGs) Quality Education; Industry, Innovation and Infrastructure

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

Hurdle Quiz

Indicative Time on Task [2]: 5 hours (Revision for quiz)

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

Test 1

Indicative Time on Task [2]: 5 hours (Revision for test)

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

Indicative Time on Task [2]: 5 hours (Revision for test)

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

Indicative Time on Task [2]: 5 hours (Revision for test)

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

Indicative Time on Task [2]: 5 hours (Revision for test)

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.

Projects

Indicative Time on Task [2]: 26 hours

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

Final Exam

Indicative Time on Task [2]: 2 hour exam plus revision time

This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

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.

[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

Assessment Tasks

Name	Weighting	Hurdle	Due
Hurdle Quiz	3%	Yes	Week 2 - in the Lecture Time Slot
Projects	22%	No	Weeks 2-13
Test 1	5%	No	Week 4 - in the Lecture Time Slot
Test 2	5%	No	Week 6 - in the Lecture Time Slot
Test 3	5%	No	Week 9 - in the Lecture Time Slot
Test 4	5%	No	Week 11 - in the Lecture Time Slot
Final Exam	55%	Yes	Scheduled S1 exam period

Hurdle Quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Week 2 - in the Lecture Time Slot**
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 2-13**

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: **Week 4 - in the Lecture Time Slot**
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: **Week 6 - in the Lecture Time Slot**
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: **Week 9 - in the Lecture Time Slot**
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: **Week 11 - in the Lecture Time Slot**
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: **Scheduled S1 exam period**
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

Practical Classes are a critical part of the delivery of this unit. The Practical Classes begin in week 1.

The main resources for the unit are the audio books. The audio books are posted to 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.

Additional short concept videos are also linked in ilearn.

Unit Schedule

Details are on iLearn

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 connect.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 Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via the Service Connect Portal, 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.

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. **UL03-UL06**

Unit information based on version 2025.03 of the Handbook