ELEC240

Signals and Systems

S2 Day 2019

School of Engineering

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General Information

Unit convenor and teaching staff
Lecturer and Convenor
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Credit points
3

Prerequisites
ENGG150 and (MATH136 or MATH133)

Corequisites
MATH235

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; 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:

Be able to solve signal processing problems involving Complex Numbers

Demonstrated understanding of how signals can be scaled in space, time, flipped in time (time-reversal), delayed (right and left shifted), and other signal properties (mean, energy, power, periodicity)

Demonstrated understanding of the concept of a linear time-invariant system and the concept of the convolution of two signals

Demonstrated understanding of 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.

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

Demonstrated use of Matlab to solve problems in Signals and Systems

General Assessment Information

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).

The hurdle quiz is a hurdle requirement. A grade of 60% or more in this quiz is a condition of passing this unit.

The final examination is a hurdle requirement. A grade of 40% or more in the final examination is a condition of passing this unit.

Late submissions of practical work are not accepted. Extenuating circumstances will be considered upon lodgement of an application for special consideration.

Assessment Tasks

Name	Weighting	Hurdle	Due
Hurdle Quiz	3%	Yes	week 2
Test 1	5%	No	Week 4

Name	Weighting	Hurdle	Due
Test 2	5%	No	week 6
Test 3	5%	No	week 9
Test 4	5%	No	week 12
Weekly Project work	17%	No	weekly
End of Semester Exam	60%	Yes	Final Exam period

Hurdle Quiz

Due: **week 2**
Weighting: **3%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

There will be a hurdle quiz in week 2 worth 3%. The quiz will take 30 minutes, and all will take place in the lecture room on Tuesday August 6 in the lecture slot. 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.

On successful completion you will be able to:

- Be able to solve signal processing problems involving Complex Numbers

Test 1

Due: **Week 4**
Weighting: **5%**

Class test on material covered in week 2 (basic signals).

The Test has 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.

On successful completion you will be able to:

- Demonstrated understanding of how signals can be scaled in space, time, flipped in time (time-reversal), delayed (right and left shifted), and other signal properties (mean, energy, power, periodicity)

Test 2

Due: **week 6**
Weighting: **5%**

Class test on material covered in weeks 3 and 4: LTI systems and convolution.

The Test has 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.

On successful completion you will be able to:

- Demonstrated understanding of the concept of a linear time-invariant system and the concept of the convolution of two signals

Test 3

Due: **week 9**
Weighting: **5%**

Class test on material covered in weeks 5,6, and 7: Fourier Series and Fourier Transforms.

The Test has 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.

On successful completion you will be able to:

- Demonstrated understanding of 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

Due: **week 12**
Weighting: **5%**

Class test on material covered in weeks 8, 9, and 10: Laplace Transform and Sampling.

The Test has 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.

On successful completion you will be able to:

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

Weekly Project work

Due: **weekly**
Weighting: **17%**

Projects will be undertaken during each practical session scheduled in weeks 1-13, and will be submitted at the end of the practical sessions. There will be a practical session in week 1.

On successful completion you will be able to:

- Demonstrated understanding of the concept of a linear time-invariant system and the concept of the convolution of two signals
- Demonstrated understanding of 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.
- Demonstrated understanding of the role of sampling and filtering in converting between continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.
- Demonstrated use of Matlab to solve problems in Signals and Systems

End of Semester Exam

Due: **Final Exam period**
Weighting: **60%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Final exam. The final exam has a hurdle requirement. Students must obtain at least 40% on final exam to pass the unit.

On successful completion you will be able to:

- Demonstrated understanding of how signals can be scaled in space, time, flipped in time (time-reversal), delayed (right and left shifted), and other signal properties (mean, energy, power, periodicity)

- Demonstrated understanding of the concept of a linear time-invariant system and the concept of the convolution of two signals
- Demonstrated understanding of 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.
- Demonstrated understanding of the role of sampling and filtering in converting between continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.

Delivery and Resources

Many textbooks 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://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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
- Grade Appeal Policy

- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

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

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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

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

If you are a Global MBA student contact globalmba.support@mq.edu.au

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.

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 outcome

- Demonstrated use of Matlab to solve problems in Signals and Systems

Assessment task

- Weekly Project work

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:

Assessment tasks

- Hurdle Quiz
- Test 1
- Test 2
- Test 3
- Test 4
- Weekly Project work

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

- Be able to solve signal processing problems involving Complex Numbers
- Demonstrated understanding of how signals can be scaled in space, time, flipped in time (time-reversal), delayed (right and left shifted), and other signal properties (mean, energy, power, periodicity)
- Demonstrated understanding of the concept of a linear time-invariant system and the concept of the convolution of two signals
- Demonstrated understanding of 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.
- Demonstrated understanding of the role of sampling and filtering in converting between continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.
- Demonstrated use of Matlab to solve problems in Signals and Systems

Assessment tasks

- Hurdle Quiz
- Test 1
- Test 2
- Test 3
- Test 4
- Weekly Project work
- End of Semester Exam

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

- Demonstrated understanding of how signals can be scaled in space, time, flipped in time (time-reversal), delayed (right and left shifted), and other signal properties (mean, energy, power, periodicity)
- Demonstrated understanding of the concept of a linear time-invariant system and the concept of the convolution of two signals
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- Demonstrated understanding of the role of sampling and filtering in converting between continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.
- Demonstrated use of Matlab to solve problems in Signals and Systems

Assessment tasks

- Test 1
- Test 2
- Test 3
- Test 4
- Weekly Project work
- End of Semester Exam

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

- Demonstrated understanding of the concept of a linear time-invariant system and the concept of the convolution of two signals
- Demonstrated understanding of 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.
- Demonstrated understanding of the role of sampling and filtering in converting between

continuous-time to discrete-time signals, including the Nyquist criterion, and concept of aliasing.

- Demonstrated use of Matlab to solve problems in Signals and Systems

Assessment tasks

- Weekly Project work
- End of Semester Exam

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:

Assessment task

- Weekly Project work