ELEC240

Signals and Systems

S2 Day 2013

Engineering

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
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Credit points
3

Prerequisites
MATH136(P) or MATH133

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; 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:

An understanding of key continuous and discrete time signal theory in the time and frequency domains.

Acquisition of fundamental skills for analysing and manipulating signals.

Understand how systems can be modelled and be able use continuous and discrete time signal theory to analyse those systems.
Be able to apply signal processing theory to typical applications in communications systems and electronics
Be able to determine and apply the underlying mathematical knowledge and techniques needed to solve signal and systems problems.
Be able to write programs in Matlab to study signal processing problems.

Assessment Tasks

Name	Weighting	Due
Assignments	20%	Throughout semester
End-of-semester examination	60%	Final exam period
Laboratories and tutorials	20%	Throughout semester

Assignments

Due: **Throughout semester**
Weighting: **20%**

Five assignments throughout the semester

On successful completion you will be able to:

- An understanding of key continuous and discrete time signal theory in the time and frequency domains.
- Acquisition of fundamental skills for analysing and manipulating signals.
- Understand how systems can be modelled and be able use continuous and discrete time signal theory to analyse those systems.
- Be able to apply signal processing theory to typical applications in communications systems and electronics
- Be able to determine and apply the underlying mathematical knowledge and techniques needed to solve signal and systems problems.

End-of-semester examination

Due: **Final exam period**
Weighting: **60%**

On successful completion you will be able to:

- An understanding of key continuous and discrete time signal theory in the time and frequency domains.
- Acquisition of fundamental skills for analysing and manipulating signals.
- Understand how systems can be modelled and be able use continuous and discrete time signal theory to analyse those systems.
- Be able to apply signal processing theory to typical applications in communications systems and electronics
- Be able to determine and apply the underlying mathematical knowledge and techniques needed to solve signal and systems problems.

Laboratories and tutorials

Due: **Throughout semester**
Weighting: **20%**

Assessment of weekly laboratory work and tutorial work.

On successful completion you will be able to:

- An understanding of key continuous and discrete time signal theory in the time and frequency domains.
- Acquisition of fundamental skills for analysing and manipulating signals.
- Understand how systems can be modelled and be able use continuous and discrete time signal theory to analyse those systems.
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- Be able to determine and apply the underlying mathematical knowledge and techniques needed to solve signal and systems problems.
- Be able to write programs in Matlab to study signal processing problems.

Delivery and Resources

Required and Recommended texts and/or materials

The textbook used is "**Signals, Systems and Transforms**" 4th ed, by Phillips, Parr and Riskin. Pearson publishers. 2008.

Matlab & Simulink Student Version Software by the MathWorks is highly recommended.

There are many other books in signal processing in the library. Books which cover similar material to ELEC240 include:

"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.

"Digital Signal Processing. Principles, Algorithms and Applications", 4th ed, J. G. Proakis and D. G. Manolakis, Pearson publishers, 2007.

"Signals and systems", S. Haykin and B. Van Veen, John Wiley &b Sons. 1999.

More advanced books include:

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

"Signals & Systems", A. V. Oppenheim and A. S. Willsky with S. H. Nawab, Prentice-Hall, 1997.

Unit Web Page

Unit lecture notes, resources, assignments and other information about the unit can be accessed through iLearn.

Technology used

Library and internet search engines, word processing software. The primary software tool used in practicals is Matlab.

Laboratory Sessions

Attendance at laboratory sessions is **compulsory**. Any student who is absent from more than two sessions may not be permitted to sit the examinations.

Experimental work and reports are to be written during the laboratory sessions with reports submitted at the end of sessions for marking. It is prohibited to use the computers in the laboratory for any purpose other than as directed.

Laboratory Safety

No student will be permitted to enter the laboratory without proper footwear. THONGS OR SANDALS ARE NOT ACCEPTABLE. NO FOOD OR DRINK may be taken into the laboratory.

What has changed?

The unit is similar to the previous offering. Only minor changes have been made.

Unit Schedule

Week	Topics
1	Continuous time signals

2	Continued
3	Continuous time LTI systems
4	Differential equations and Laplace transforms
5	Fourier series
6	Fourier transforms
7	Application of Fourier transforms
8	Discrete time signals
9	Discrete time LTI systems
10	Discrete time Fourier transforms (DTFT) and Discrete Fourier transform (DFT)
11	z-transforms
12	Digital filters
13	Digital filter design

Learning and Teaching Activities

Lectures

There is a one-hour and a two-hour lecture each week devoted to theory and concepts. Part of the two-hour lecture will be used for tutorial problems.

Practicals

Practical sessions will be on the use of Matlab to solve signal processing problems and for doing tutorial work. Tutorial work and practicals are assessed weekly.

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://www.mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://www.mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://www.mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://www.mq.edu.au/policy/docs/gradeappeal/policy.html

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Special Consideration Policy http://www.mq.edu.au/policy/docs/special_consideration/policy.html

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Late tutorial problems will receive a 10% mark penalty for every day late. Exceptions to this may

be made for individuals with the appropriate medical certificate.

Late Practical Reports will receive a 10% mark penalty for every day late. Exceptions to this may be made for individuals with the appropriate medical certificate.

Assignments will receive a 10% mark penalty for every day late. Exceptions to this may be made for individuals with the appropriate medical certificate.

Applications for extension of time to submit Tutorial Problems, Practical Reports, or Assignments must be lodged on:

http://ask.mq.edu.au

The request must include a copy of the medical certificate.

No extensions of time for Tutorial Problems, Practical Reports, or Assignaments wil be granted without the appropriate medical certificate.

Student Support

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at: http://students.mq.edu.au/support/

UniWISE provides:

- Online learning resources and academic skills workshops http://www.students.mq.edu.au/support/learning_skills/
- Personal assistance with your learning & study related questions.
- The Learning Help Desk is located in the Library foyer (level 2).
- Online and on-campus orientation events run by Mentors@Macquarie.

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

Details of these services can be accessed at http://www.student.mq.edu.au/ses/.

IT Help

If you wish to receive IT help, we would be glad to assist you at 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 and it outlines what can be done.

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

- Understand how systems can be modelled and be able use continuous and discrete time signal theory to analyse those systems.
- Be able to apply signal processing theory to typical applications in communications systems and electronics

Assessment task

- Laboratories and tutorials

Learning and teaching activity

- Practical sessions will be on the use of Matlab to solve signal processing problems and for doing tutorial work. Tutorial work and practicals are assessed weekly.

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

- An understanding of key continuous and discrete time signal theory in the time and frequency domains.
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- Be able to determine and apply the underlying mathematical knowledge and techniques needed to solve signal and systems problems.
- Be able to write programs in Matlab to study signal processing problems.

Assessment tasks

- Assignments
- Laboratories and tutorials

Learning and teaching activities

- There is a one-hour and a two-hour lecture each week devoted to theory and concepts. Part of the two-hour lecture will be used for tutorial problems.
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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:

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Assessment tasks

- Assignments
- End-of-semester examination

- Laboratories and tutorials

Learning and teaching activities

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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

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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:

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Assessment tasks

- Assignments
- End-of-semester examination
- Laboratories and tutorials

Learning and teaching activities

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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

- An understanding of key continuous and discrete time signal theory in the time and

frequency domains.
- Acquisition of fundamental skills for analysing and manipulating signals.
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Assessment tasks

- Assignments
- End-of-semester examination
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Learning and teaching activities

- Practical sessions will be on the use of Matlab to solve signal processing problems and for doing tutorial work. Tutorial work and practicals are assessed weekly.

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 outcomes

- An understanding of key continuous and discrete time signal theory in the time and frequency domains.
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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 outcome

- Be able to apply signal processing theory to typical applications in communications systems and electronics

Satisfactory completion

A satisfactory performance in ALL aspects of the unit is required to pass.