ELEC620

Signal Analysis for Telecommunications

S2 Day 2018

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
Unit convener
Ahsan Ali
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Contact via Email
44 Waterloo Rd Level 1
Thursday 3pm-4pm

Credit points
4

Prerequisites
Admission to MEng

Corequisites

Co-badged status

Unit description
This unit develops the mathematical knowledge and skills required to understand the generation, transfer and processing of signals in data communications systems. Topics include: deterministic signal analysis in continuous and discrete time, linear time invariant systems, Fourier analysis and the basic probability, statistics and random processes theory needed to model noise processes, analyse signal-to-noise ratio, determine channel capacity, detect signals and determine bit error probabilities.

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:

Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems

Apply the mathematical theory of time domain and frequency domain techniques to signals and systems.

Apply probability theory and random variable theory to basic problems and their applications.

Apply random process theory to problems and their applications.

To have skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of signal processing.

General Assessment Information

Assignment Tasks

Assignment **p**roblems will be posted on iLearn at least two weeks before their submission date. Assignment solutions will be posted within one week after the submission date. Submissions will not be accepted once the solution is posted. All assignments and reports must be submitted electronically through iLearn (in pdf format). Resubmissions will be permitted up to due date.

Extension requests

Must be supported by evidence of medical conditions or misadventure. Extension requests must be submitted through the Ask online system.

Penalties for late submission

Late assignments may incur a penalty of 10% for each day late.

Resubmission options

Once an assignment submission has closed no resubmission of assignments will be permitted.

Hurdle requirements

There are no hurdle requirements.

Satisfactory Completion

To obtain a passing grade (P, Cr, D, HD) an overall mark of 50 or more is required.

Assessment Tasks

Name	Weighting	Hurdle	Due
Participation	8%	No	weekly
Assignment 1	10%	No	Week 5
Assignment 2	10%	No	Week 8
Assignment 3	10%	No	Week 10
Assignment 4	10%	No	Week 13
End of Semester Exam	26%	No	scheduled in final exam period

Name	Weighting	Hurdle	Due
In-class test 1	13%	No	Week 5
In-class test 2	13%	No	Week 8

Participation

Due: **weekly**
Weighting: **8%**

This requires student to actively participate in class activities.

On successful completion you will be able to:

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
- Apply the mathematical theory of time domain and frequency domain techniques to signals and systems.
- Apply probability theory and random variable theory to basic problems and their applications.
- Apply random process theory to problems and their applications.
- To have skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of signal processing.

Assignment 1

Due: **Week 5**
Weighting: **10%**

Problems on signal properties, linear time-invariant systems, convolution and impulse response and related topics.

On successful completion you will be able to:

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
- Apply the mathematical theory of time domain and frequency domain techniques to signals and systems.
- To have skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of signal processing.

Assignment 2

Due: **Week 8**

Weighting: **10%**

Problems on Fourier Series, Fourier Transform and related topics.

On successful completion you will be able to:

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
- Apply the mathematical theory of time domain and frequency domain techniques to signals and systems.
- To have skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of signal processing.

Assignment 3

Due: **Week 10**
Weighting: **10%**

Problems on probability and random variables and related topics.

On successful completion you will be able to:

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
- Apply probability theory and random variable theory to basic problems and their applications.
- Apply random process theory to problems and their applications.
- To have skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of signal processing.

Assignment 4

Due: **Week 13**
Weighting: **10%**

Problems on random processes and related topics.

On successful completion you will be able to:

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
- Apply probability theory and random variable theory to basic problems and their applications.
- Apply random process theory to problems and their applications.
- To have skills in self learning and monitoring so as to be able to learn new areas and

assist in problem solving in various areas of signal processing.

End of Semester Exam

Due: **scheduled in final exam period**
Weighting: **26%**

Final exam on probability, random variables and stochastic processes

On successful completion you will be able to:

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
- Apply the mathematical theory of time domain and frequency domain techniques to signals and systems.
- Apply probability theory and random variable theory to basic problems and their applications.
- Apply random process theory to problems and their applications.

In-class test 1

Due: **Week 5**
Weighting: **13%**

One hour In-class test on time-domain signals and systems.

On successful completion you will be able to:

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
- Apply the mathematical theory of time domain and frequency domain techniques to signals and systems.

In-class test 2

Due: **Week 8**
Weighting: **13%**

One hour in-class test on Fourier transforms

On successful completion you will be able to:

- Apply the mathematical theory of time domain and frequency domain techniques to signals and systems.

Delivery and Resources

Classes

The timetable of lectures/tutorials/practicals is available on: http://www.timetables.mq.edu.au/

Required and Recommended Texts and/or Materials

Text book

There is no set textbook for this unit. See below for a list of useful references.

Notes

Lecture and tutorial notes will be provided as required.

Recommended readings

See iLearn page

Technology Used and Required

The main software tool used will be Matlab.

Unit Web Page

Access from the online iLearn Learning System at http://ilearn.mq.edu.au

Laboratory rules

Food and drink are not permitted in the laboratory. Students will not be permitted to enter the laboratory without appropriate footwear. Thongs and sandals are not acceptable.

Notifications

Formal notification of assessment tasks and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, The University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

Useful references.

Signals and systems

“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.

"Signals and systems", Haykin and Van Veen, Wiley.

“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.

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

Communication systems

"Theory and design of digital communication systems", T. T. Ha, Cambridge, 2011.

"Communication systems", S. Haykin, 4th ed Wiley.2001.

"Fundamentals of wireless communication", D. Tse and P. Viswanath, Cambridge, 2005.

"Modern digital and analog communication systems", Lathi and Ding, Oxford,

"Communication systems design", Proakis and Salehi, Prentice-Hall.

"A first course in digital communications", Nguyen and Shewedyk, Cambridge.

Books on probability and random processes:

Schaum's outlines Probability, Random Variables, & Random Processes by Hwei P. Hsu

Probability, Statistics, and Random Processes for Electrical Engineering Third Edition by Alberto Leon-Garcia

Probability, Statistics, and Random Processes for Engineers by Richard H. Williams

Probability and Stochastic Processes: A Friendly Introduction for Electrical and Computer Engineers by Roy D. Yates and David J. Goodman

Unit Schedule

See ilearn for the list of topics and schedule.

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 shown in *iLearn*, 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.

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

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 outcomes

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
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Assessment tasks

- Participation
- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- In-class test 1
- In-class test 2

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:

Assessment tasks

- Participation
- Assignment 3
- Assignment 4

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 outcome

- To have skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of signal processing.

Assessment tasks

- Participation
- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4

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

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systems and their applications, especially in communications systems
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- Assignment 3
- Assignment 4
- End of Semester Exam
- In-class test 1
- In-class test 2

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

- Describe and apply mathematical techniques to solve problems involving signals and systems and their applications, especially in communications systems
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- In-class test 2

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

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- Assignment 3
- Assignment 4
- End of Semester Exam
- In-class test 1

- In-class test 2

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 tasks

- Participation
- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- End of Semester Exam

Changes from Previous Offering

In-class tests have been added to assess time-domain (Week 5 test) and Frequency domain (Week 8 test) . Final exam only covers probability, random variables and random processes. Introductory mathematical background address to start of unit. Matlab learning outcome has been removed.

Changes in response to student feedback

See changes to previous offering.