TELE3001

Random Signals for Communications

Session 1, Fully online/virtual 2021

School of Engineering

Contents

Notice

As part of Phase 3 of our return to campus plan, most units will now run tutorials, seminars and other small group activities on campus, and most will keep an online version available to those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face activities for your unit, please go to timetable viewer. To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

General Information

Unit convenor and teaching staff
Lecturer, unit convenor
Rein Vesilo
rein.vesilo@mq.edu.au
Contact via Email
Online
Monday 2pm-3pm

Ali Lalbakhsh
ali.lalbakhsh@mq.edu.au

Credit points
10

Prerequisites
((ELEC2040 or ELEC240 or MATH235 or MATH2055) and 130cp at 1000 level or above) or Admission to MEngNetTeleEng

Corequisites

Co-badged status

Unit description
This unit of study is on the mathematical treatment of randomness and probability. More specifically, it covers basic probability theory, random variables, random vectors, probability functions, probability models, the elements of statistical inference and hypothesis testing, random processes and random signals. It uses digital communication systems as the primary example and covers noise processes and the analysis of linear systems with random signals as inputs and outputs from time domain and frequency domain perspectives using examples such as pulse detection and matched filters.

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: Describe and apply basic theory of probability, random variables, probability distributions to represent and solve problems involving uncertainty and randomness.

ULO2: Use time and frequency techniques to analyse random signals and power, including spectral power density and autocorrelation functions.
ULO3: Use probability, random variable techniques as well as basic statistical techniques such as estimation and hypothesis testing to analyse fundamental signal processing techniques in communications systems.
ULO4: Use linear systems theory to analyse systems with deterministic and random signals as inputs and outputs.
ULO5: Demonstrate skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of probability and random signal processing.

General Assessment Information

Assignment Tasks

Assignment problems 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. For further details about grading, please refer below in the policies and procedures section.

Special Consideration and Supplementary Examinations

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.

Assessment Tasks

Name	Weighting	Hurdle	Due
Practical quiz - online	15%	No	Weeks 3,5,7,9,11
Final examination - online quiz	22%	No	Final examination period
Assignments	35%	No	Weeks 5, 8, 10,12
Class participation - online	6%	No	Weeks 2-12
Final examination - take home	22%	No	Final examination period

Practical quiz - online

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 0 hours
Due: **Weeks 3,5,7,9,11**
Weighting: **15%**

5 short quizzes held during practical sessions.

On successful completion you will be able to:

- Describe and apply basic theory of probability, random variables, probability distributions to represent and solve problems involving uncertainty and randomness.
- Use time and frequency techniques to analyse random signals and power, including spectral power density and autocorrelation functions.
- Use probability, random variable techniques as well as basic statistical techniques such as estimation and hypothesis testing to analyse fundamental signal processing techniques in communications systems.
- Use linear systems theory to analyse systems with deterministic and random signals as inputs and outputs.

Final examination - online quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 9 hours
Due: **Final examination period**
Weighting: **22%**

For the online offering, an online quiz will be used as part of the final assessment of the unit instead of a formal 3 hour written examination. This online quiz counts for 25% of the unit assessment. The other part of the final assessment in the unit in the online offering is a take-home test, worth 25% of the unit assessment.

On successful completion you will be able to:

- Describe and apply basic theory of probability, random variables, probability distributions to represent and solve problems involving uncertainty and randomness.
- Use time and frequency techniques to analyse random signals and power, including spectral power density and autocorrelation functions.
- Use probability, random variable techniques as well as basic statistical techniques such as estimation and hypothesis testing to analyse fundamental signal processing techniques in communications systems.
- Use linear systems theory to analyse systems with deterministic and random signals as inputs and outputs.
- Demonstrate skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of probability and random signal processing.

Assignments

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 40 hours
Due: **Weeks 5, 8, 10,12**
Weighting: **35%**

Four assignments throughout the session

On successful completion you will be able to:

- Describe and apply basic theory of probability, random variables, probability distributions to represent and solve problems involving uncertainty and randomness.
- Use time and frequency techniques to analyse random signals and power, including spectral power density and autocorrelation functions.
- Use probability, random variable techniques as well as basic statistical techniques such as estimation and hypothesis testing to analyse fundamental signal processing techniques in communications systems.
- Use linear systems theory to analyse systems with deterministic and random signals as inputs and outputs.
- Demonstrate skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of probability and random signal processing.

Class participation - online

Assessment Type [1]: Participatory task
Indicative Time on Task [2]: 0 hours
Due: **Weeks 2-12**
Weighting: **6%**

Students will be asked to do participation exercises as part of lectures via ilearn instructions on a variety of problems activities to improve understanding. Scanned sheets of work will be submitted through ilearn.

On successful completion you will be able to:

- Describe and apply basic theory of probability, random variables, probability distributions to represent and solve problems involving uncertainty and randomness.
- Use time and frequency techniques to analyse random signals and power, including spectral power density and autocorrelation functions.
- Use probability, random variable techniques as well as basic statistical techniques such as estimation and hypothesis testing to analyse fundamental signal processing techniques in communications systems.
- Use linear systems theory to analyse systems with deterministic and random signals as inputs and outputs.
- Demonstrate skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of probability and random signal

processing.

Final examination - take home

Assessment Type [1]: Examination
Indicative Time on Task [2]: 10 hours
Due: **Final examination period**
Weighting: **22%**

For the online offering, a take home examination is part of the final assessment in the unit, in place of a formal 3 hour written examination. The other part of the final assessment in the unit for the online offering is an online quiz.

On successful completion you will be able to:

- Describe and apply basic theory of probability, random variables, probability distributions to represent and solve problems involving uncertainty and randomness.
- Use time and frequency techniques to analyse random signals and power, including spectral power density and autocorrelation functions.
- Use probability, random variable techniques as well as basic statistical techniques such as estimation and hypothesis testing to analyse fundamental signal processing techniques in communications systems.
- Use linear systems theory to analyse systems with deterministic and random signals as inputs and outputs.
- Demonstrate skills in self learning and monitoring so as to be able to learn new areas and assist in problem solving in various areas of probability and random signal processing.

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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

Classes

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

PRACTICAL CLASSES will start in WEEK 1

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.

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

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.

Analytical thinking

"Writing analytically Eighth Edition" David Rosenwasser and Jill Stephen, Cengage.

Unit Schedule

See iLearn for unit schedule

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
- Grade Appeal Policy
- Complaint Management 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

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 help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- 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

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.

Changes from Previous Offering

The changes to the unit are minor. The main changes are are modifications to exercises to improve unit engagement.

Unit Description (Copied)

This unit of study is on the mathematical treatment of randomness and probability. More specifically, it covers basic probability theory, random variables, random vectors, probability functions, probability models, the elements of statistical inference and hypothesis testing, random processes and random signals. It uses digital communication systems as the primary example and covers noise processes and the analysis of linear systems with random signals as inputs and outputs from time domain and frequency domain perspectives using examples such as pulse detection and matched filters.