



# ELEC321

## Communication Systems

S2 Day 2018

*Dept of Engineering*

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## General Information

Unit convenor and teaching staff

Convenor

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Thursday, 3-5 pm

Tutor

Shahidul Islam

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Credit points

3

Prerequisites

ELEC240 and (STAT394 or MATH396) and (MATH232 or MATH235)

Corequisites

Co-badged status

Unit description

This unit explores: Fourier theory, including frequency-time duality; analogue amplitude and frequency modulation; digital communication systems, including sampling, modulation and demodulation methods, source and line coding, multi-symbol signalling; noise and its effects including noise types and spectrum, information capacity, noise measures, noise performance of digital communication systems, error-control coding and decoding; and communication-system case studies.

## 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:

Understanding the concepts of the transmission of information by analogue communication systems.

Understanding the concepts of the transmission of information by digital communication systems.

Ability to apply mathematical methods to the design and analysis of communication systems.

Understanding the role of the professional engineer in the design and operation of communication systems.

Ability to conduct laboratory experiments using advanced communication systems and equipment.

## General Assessment Information

Late submissions of Assignments and Laboratory Reports will incur a penalty of 10% of the grade for every late submission calendar day.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Tutorial Questions</a>	5%	No	Every tutorial
<a href="#">Laboratory Report 1</a>	10%	No	2 September 2018
<a href="#">Laboratory Report 2</a>	10%	No	7 October 2018
<a href="#">Laboratory Report 3</a>	5%	No	28 October 2018
<a href="#">Assignment 1</a>	10%	No	2 September 2018
<a href="#">Assignment 2</a>	10%	No	28 October 2018
<a href="#">Final Examination</a>	50%	No	Final Examination Week

## Tutorial Questions

Due: **Every tutorial**

Weighting: **5%**

One tutorial question must be solved prior to the tutorial class and handed-in at the beginning of the tutorial class.

On successful completion you will be able to:

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication

systems.

- Ability to apply mathematical methods to the design and analysis of communication systems.

## Laboratory Report 1

Due: **2 September 2018**

Weighting: **10%**

Laboratory Report on Fourier Series, Modulation, Introduction to TIMS Laboratory Equipment, and QAM.

On successful completion you will be able to:

- Understanding the concepts of the transmission of information by analogue communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

## Laboratory Report 2

Due: **7 October 2018**

Weighting: **10%**

Sampling, reconstruction, QPSK, and Bit Error Rate.

On successful completion you will be able to:

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

## Laboratory Report 3

Due: **28 October 2018**

Weighting: **5%**

Laboratory report on visits to Optus Communications and the CSIRO.

On successful completion you will be able to:

- Understanding the role of the professional engineer in the design and operation of communication systems.

## Assignment 1

Due: **2 September 2018**

Weighting: **10%**

Assignment on Analog Communication Systems

On successful completion you will be able to:

- Understanding the concepts of the transmission of information by analogue communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.

## Assignment 2

Due: **28 October 2018**

Weighting: **10%**

Assignment on Digital Communication Systems

On successful completion you will be able to:

- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.

## Final Examination

Due: **Final Examination Week**

Weighting: **50%**

Final Examination on Analog and Digital Communication Systems

On successful completion you will be able to:

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.

- Ability to apply mathematical methods to the design and analysis of communication systems.

## Delivery and Resources

Lecture materials, Tutorial Questions, Assignment Question, and Assignment Solutions will be uploaded to iLearn.

Lectures will be recorded on Echo Recordings.

Laboratories will use TIMS electronic modules manufactured by Emona Instruments and will also use Universal Software Radio Peripheral (USRP) modules and LabVIEW software supplied by National Instruments.

Recommended readings are ELEC321 lecture notes and the following reference books:

- S. Haykin, Communications Systems, 5th Edition, Wiley.
- B.P. Lathi, Z. Ding, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press.
- L.W. Couch, II, Digital and Analogue Communication Systems, 6th or 7th Edition, Prentice Hall.
- S. Haykin, M. Moher, Introduction to Digital and Analog Communications, 2nd Edition, Wiley.
- B. Sklar. Digital Communications: Fundamentals and Applications, 2nd Edition, Prentice-Hall.
- H. Nguyen, E. Shwedyk, A First Course in Digital Communications, 1st Edition, Cambridge
- J.G. Proakis, M. Salehi, and G. Bauch, Contemporary Communication Systems Using Matlab, 2nd Edition, C.L. Engineering.
- D. Silage, Digital Communication Systems using Matlab and Simulink, Bookstand Publishing.
- Won Y. Yang, Matlab/Simulink for Digital Communication, First Edition, A-Jin Publishing.
- The Mathworks, MATLAB & Simulink Student Version 2011a, Prentice Hall.

## 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) (<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](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://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](http://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](http://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](http://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/](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

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.
- Understanding the role of the professional engineer in the design and operation of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

### Assessment tasks

- Tutorial Questions
- Laboratory Report 1
- Laboratory Report 2
- Assignment 1
- Assignment 2
- Final Examination



## 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

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Understanding the role of the professional engineer in the design and operation of communication systems.

### Assessment tasks

- Laboratory Report 2
- Laboratory Report 3
- Assignment 1
- Assignment 2
- Final Examination

## 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

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.

- Understanding the role of the professional engineer in the design and operation of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

## **Assessment tasks**

- Laboratory Report 1
- Laboratory Report 2
- Laboratory Report 3
- Assignment 1
- Assignment 2
- Final Examination

## **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**

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.
- Understanding the role of the professional engineer in the design and operation of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

## **Assessment tasks**

- Tutorial Questions
- Laboratory Report 1

- Laboratory Report 2
- Laboratory Report 3
- Assignment 1
- Assignment 2
- Final Examination

## 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

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

### Assessment tasks

- Tutorial Questions
- Laboratory Report 1
- Laboratory Report 2
- Assignment 1
- Assignment 2
- Final Examination

## 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

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

## Assessment tasks

- Tutorial Questions
- Laboratory Report 1
- Laboratory Report 2
- Assignment 1
- Assignment 2
- Final Examination

## 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

- Understanding the concepts of the transmission of information by analogue communication systems.
- Understanding the concepts of the transmission of information by digital communication systems.
- Ability to apply mathematical methods to the design and analysis of communication systems.
- Understanding the role of the professional engineer in the design and operation of communication systems.
- Ability to conduct laboratory experiments using advanced communication systems and equipment.

## Assessment tasks

- Tutorial Questions
- Laboratory Report 1
- Laboratory Report 2
- Laboratory Report 3
- Assignment 1
- Assignment 2
- Final Examination

## 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 outcomes

- Ability to apply mathematical methods to the design and analysis of communication systems.
- Understanding the role of the professional engineer in the design and operation of communication systems.

### Assessment task

- Laboratory Report 3

## Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

### Learning outcome

- Understanding the role of the professional engineer in the design and operation of communication systems.

## Assessment task

- Laboratory Report 3

## Changes in Response to Student Feedback

Additional worked example problems will be presented in lecture and tutorial.