



# ELEC426

## Advanced Telecommunications Engineering

S1 Day 2019

*School of Engineering*

### Contents

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<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	2
<a href="#"><u>General Assessment Information</u></a>	3
<a href="#"><u>Assessment Tasks</u></a>	3
<a href="#"><u>Delivery and Resources</u></a>	6
<a href="#"><u>Unit Schedule</u></a>	7
<a href="#"><u>Policies and Procedures</u></a>	7
<a href="#"><u>Graduate Capabilities</u></a>	9
<a href="#"><u>Changes from Previous Offering</u></a>	14
<a href="#"><u>Changes in response to student feedback</u></a>	14

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit convenor

Rein Vesilo

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44 Waterloo Rd Level 1

Tuesday 11am-12noon

Credit points

3

Prerequisites

(60cp at 100 level or above) including (ELEC321(P) and ELEC345)

Corequisites

Co-badged status

ELEC626

Unit description

This unit is the capstone unit for the Telecommunications Engineering major integrating prior learning in a specialist area of engineering with problem solving, emerging technology and aspects of engineering application, technical reporting and self-management to prepare students to work at a professional capacity. The unit aims to address the application of fundamental principles and methods at an advanced level in the context of standards and practices, modelling, analysis, design and practical implementation. The unit also develops skills in the critical evaluation of information, software, simulation and experimental methods. Learning will be achieved using a variety of modes including laboratories, group work and traditional lecture format. The specific topics will focus on current advances in the area such as resource allocation, performance analysis, scheduling, link and network design, mobility, and medium-access protocols, in various types of wireless networks.

## 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 advanced concepts and techniques in telecommunications, cellular

and wireless networks, resource allocation, network design and wireless communication theory.

Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.

Ability to conduct simulation experiments using software simulation tools and report on outputs

Ability to describe, explain and critique research literature related to telecommunications

## 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.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Assignment 1</a>	10%	No	Week 5

Name	Weighting	Hurdle	Due
<a href="#"><u>Assignment 2</u></a>	10%	No	Week 8
<a href="#"><u>Participation 1</u></a>	3%	No	Weeks 2-6
<a href="#"><u>Assignment 3</u></a>	10%	No	Week 10
<a href="#"><u>Assignment 4</u></a>	10%	No	Week 13
<a href="#"><u>Participation 2</u></a>	3%	No	Weeks 7-13
<a href="#"><u>Final Examination</u></a>	54%	No	University Examination Period

## Assignment 1

Due: **Week 5**

Weighting: **10%**

A combination tasks involving theory and problem solving

On successful completion you will be able to:

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on outputs
- Ability to describe, explain and critique research literature related to telecommunications

## Assignment 2

Due: **Week 8**

Weighting: **10%**

A combination tasks involving theory and problem solving

On successful completion you will be able to:

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced

telecommunications and wireless systems and networks.

- Ability to conduct simulation experiments using software simulation tools and report on outputs
- Ability to describe, explain and critique research literature related to telecommunications

## Participation 1

Due: **Weeks 2-6**

Weighting: **3%**

Participation in lectures and tutorials.

On successful completion you will be able to:

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.

## Assignment 3

Due: **Week 10**

Weighting: **10%**

Matlab based problems.

On successful completion you will be able to:

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on outputs

## Assignment 4

Due: **Week 13**

Weighting: **10%**

A combination of theory and Matlab based problems.

On successful completion you will be able to:

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to describe, explain and critique research literature related to telecommunications

## Participation 2

Due: **Weeks 7-13**

Weighting: **3%**

Participation in lectures and tutorials

On successful completion you will be able to:

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.

## Final Examination

Due: **University Examination Period**

Weighting: **54%**

3-hour, closed book exam

On successful completion you will be able to:

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.

## 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.

### Reference book(s)

- A. Goldsmith, Wireless Communications, Cambridge University Press, 2005.

### Notes

Lecture and tutorial notes will be provided as required.

### Recommended readings

See iLearn page

## Technology Used and Required

Various hardware and software tools for analysis, simulation and testing and experimentation of communication systems.

### 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.

## Unit Schedule

Week	Lectures/Tutorials
Weeks 1-6	Resource allocation and optimisation in wireless networks
Weeks 7-12	Path loss, statistical multipath fading models, simulation of digital communication systems
Week 13	Revision

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](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 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](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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](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)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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/](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 advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on outputs

### Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Participation 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:

## **Learning outcomes**

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on outputs
- Ability to describe, explain and critique research literature related to telecommunications

## **Assessment tasks**

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

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on

outputs

- Ability to describe, explain and critique research literature related to telecommunications

## Assessment tasks

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

## 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

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on outputs
- Ability to describe, explain and critique research literature related to telecommunications

## Assessment tasks

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

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication theory.
- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on outputs
- Ability to describe, explain and critique research literature related to telecommunications

### Assessment tasks

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

- Describe and apply advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, network design and wireless communication

theory.

- Ability to apply mathematical and optimisation methods to the analysis of advanced telecommunications and wireless systems and networks.
- Ability to conduct simulation experiments using software simulation tools and report on outputs
- Ability to describe, explain and critique research literature related to telecommunications

## **Assessment tasks**

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

- Ability to conduct simulation experiments using software simulation tools and report on outputs
- Ability to describe, explain and critique research literature related to telecommunications

## **Assessment tasks**

- Assignment 1
- Assignment 3
- Assignment 4
- Participation 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 outcome**

- Ability to describe, explain and critique research literature related to telecommunications

### **Assessment task**

- Assignment 1

## **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**

- Ability to describe, explain and critique research literature related to telecommunications

### **Assessment task**

- Assignment 1

## **Changes from Previous Offering**

There are no major changes to the unit.

## **Changes in response to student feedback**

No major changes.