



ELEC426

Advanced Telecommunications Engineering

S1 Day 2015

Dept of Engineering

Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	3
<u>Assessment Tasks</u>	3
<u>Delivery and Resources</u>	7
<u>Unit Schedule</u>	8
<u>Policies and Procedures</u>	9
<u>Graduate Capabilities</u>	10
<u>Changes from Previous Offering</u>	15

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General Information

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Credit points

3

Prerequisites

ELEC321(P) and ELEC345(P)

Corequisites

Co-badged status

Unit description

This unit integrates 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 and sources of error and experimental methods. Learning will be achieved using case studies, laboratories, presentations, group work and traditional lecture format. The specific topics will focus on current advances in the area such as resource allocation, performance analysis, scheduling, network design, mobility, handover, medium-access protocols, and energy efficiency in cellular, mesh, ad hoc and other kinds 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:

Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.

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

Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment

Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Assessment Tasks

Name	Weighting	Due
Practical Assignment 1	15%	Week 6
Tutorial 1	5%	Weeks 2-5
Assignment 2	15%	Week 10
Practical 2	5%	Weeks 6-9

Name	Weighting	Due
Assignment 3	15%	Week 13
Practical 3	5%	Weeks 10-13
Final Examination	40%	University Examination Period

Practical Assignment 1

Due: **Week 6**

Weighting: **15%**

The assignment will involve conducting laboratory experiments using wireless sensor network devices. The length of the assignment report is not specified but it is not expected to be more than 20 pages overall (including figures).

On successful completion you will be able to:

- Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Tutorial 1

Due: **Weeks 2-5**

Weighting: **5%**

Tutorials will involve questions and problems based on lecture material. Each week at the beginning of the tutorial session students should provide their answers to one of the questions highlighted in the tutorial question sheet for that week to the tutor for marking.

On successful completion you will be able to:

- Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications

systems and networks.

Assignment 2

Due: **Week 10**

Weighting: **15%**

A combination of theory and Matlab based problems.

On successful completion you will be able to:

- Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Practical 2

Due: **Weeks 6-9**

Weighting: **5%**

Matlab based problems.

On successful completion you will be able to:

- Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment

Assignment 3

Due: **Week 13**

Weighting: **15%**

The assignment will be a set of theory based problems.

On successful completion you will be able to:

- Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Practical 3

Due: **Weeks 10-13**

Weighting: **5%**

Practicals will involve questions and problems based on lecture material. Each week at the beginning of the practical session students should provide their answers to one of the questions highlighted in the practical question sheet for that week to the tutor for marking.

On successful completion you will be able to:

- Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.

Final Examination

Due: **University Examination Period**

Weighting: **40%**

3-hour, closed book

On successful completion you will be able to:

- Understanding of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.

Delivery and Resources

Satisfactory Completion

A pass mark in the assignment component as a whole and a pass mark in the final examination are needed to satisfactorily complete the unit.

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)

- F. Akyildiz and M. C. Vuran, Wireless Sensor Networks, 1st Edition, Wiley 2010.
- A. Goldsmith, Wireless Communications, Cambridge University Press, 2005.

Notes

Lecture and tutorial notes will be provided as required.

Recommended readings

TBA

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.

Laboratory note book

Each student must have a bound exercise book to be used as a tutorial/laboratory note book.

Extension requests

Must be supported by evidence of medical conditions or misadventure. Extension requests must be submitted through Disruption to Studies 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.

Unit Schedule

Week	Lectures/Tutorials	Practicals	Events
Week 1	Introduction to wireless sensor networks; Energy consumption in wireless sensor networks		
Week 2	Medium access control in wireless sensor networks - Part 1	Assignment 1 session 1	
Week 3	Medium access control in wireless sensor networks - Part 2	Assignment 1 session 2	
Week 4	Routing in wireless sensor networks - Part 1	Assignment 1 session 3	
Week 5	Simulation of digital communication systems	Assignment 1 session 4	
Week 6	Pathloss and shadowing	Assignment 2 session 1	Assignment 1 due
Week 7	Statistical multipath fading models - Part 1	Assignment 2 session 2	
Week 8	Statistical multipath fading models - Part 2	Assignment 2 session 3	
Week 9	Constrained optimization 1	Assignment 2 session 4	
Week 10	Constrained optimization 2	Assignment 3 session 1	Assignment 2 due
Week 11	Resource allocation 1	Assignment 3 session 2	
Week 12	Resource allocation 2	Assignment 3 session 3	

Week 13	Revision	Assignment 3 session 4	Assignment 3 due
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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://mq.edu.au/policy/docs/academic_honesty/policy.html

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

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

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

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

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of 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/support/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://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.

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 of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment

Assessment tasks

- Practical Assignment 1
- Assignment 2
- Practical 2
- Practical 3

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

- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Assessment tasks

- Practical Assignment 1
- Assignment 2
- Practical 2
- Assignment 3
- Practical 3
- 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 of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment
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Assessment tasks

- Practical Assignment 1
- Assignment 2
- Practical 2
- Assignment 3
- Practical 3

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 of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Assessment tasks

- Practical Assignment 1
- Tutorial 1
- Assignment 2
- Practical 2
- Assignment 3
- Practical 3
- 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 of the advanced concepts and techniques in telecommunications, cellular and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.
- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Assessment tasks

- Practical Assignment 1
- Tutorial 1
- Assignment 2
- Practical 2
- Assignment 3
- Practical 3
- 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 of the advanced concepts and techniques in telecommunications, cellular

and wireless networks, resource allocation, scheduling, network design, energy efficiency and performance analysis.

- Ability to apply mathematical methods to the analysis of advanced telecommunications systems and networks.
- Ability to conduct laboratory experiments using advanced networks, systems, simulation tools, and equipment
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Assessment tasks

- Practical Assignment 1
- Tutorial 1
- Assignment 2
- Practical 2
- Assignment 3
- Practical 3
- 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 laboratory experiments using advanced networks, systems, simulation tools, and equipment
- Ability to understand, critique and assess research literature related to telecommunications including delivery of outputs as a report and as a presentation

Assessment tasks

- Practical Assignment 1
- Practical 2
- Assignment 3
- Practical 3
- 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:

Assessment task

- Practical 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:

Assessment task

- Practical Assignment 1

Changes from Previous Offering

In 2015 the unit will be divided into three modules of 4 weeks each given by different lecturers. This is different from the 2014 offering which was divided into two 6 week modules.