MONASH University

Unit Guide

ECE5884
Wireless communications

Semester 2, 2017

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Unit handbook information

Synopsis

This unit introduces the fundamentals of wireless communications and networking. Students will learn about the characteristics of wireless channels, coding, modulation techniques, methods of combating fading including space, time and frequency diversity, multiple access techniques and cellular networks.
A selection of more advanced topics will also be covered including MIMO systems, heterogeneous networks, cognitive and cooperative communications.

Mode of delivery

Clayton (Day)

Workload requirements

3 hours lectures/tutorials, 3 hours laboratory and 6 hours of private study per week.

Unit relationships

Prerequisites

None

Prohibitions

None

Co-requisites

None

Chief Examiner(s)

Professor Manos Varvarigos

Unit Coordinator(s)

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Academic Overview

Engineers Australia Stage 2 competencies

The Engineers Australia Policy on Accreditation of Professional Engineering Programs requires that all programs ensure that their engineering graduates develop to a substantial degree the stage 2 competencies. Listed below are the activities in this unit that will help you to achieve these competencies.

Note: that not all stage 2 competencies are relevant to each unit.

TBD by the Faculty

Teaching and learning method

Lectures and Tutorials

There will be three set contact hours per week for face-to-face teaching in this unit. We will assume that relevant material has been read before these contact hours and this will be encouraged through online quizzes and preliminary lab work. We will run these contact hours as a mix between traditional lectures and tutorials and they will be very interactive. In the implementation component of the unit you will work to implement a communication system using software-defined-radios. The relevant laboratory will be open for seven hours every week to enable you to complete the set tasks.

Learning outcomes

At the successful completion of this unit you will be able to:

1. Identify common radio channel impairments such as noise, fading and interference to synthesise theoretical channel models.
2. Determine theoretical error-performance of wireless systems for comparison against practical measurements.
3. Analyse theoretical capacity of wireless communication systems that employ spatial and temporal diversity methods.

4. Design appropriate transmitter and receiver signal processing functionalities for wireless systems and demonstrate its performance on a software defined radio hardware platform.
5. Assess space-time coding schemes that are capable of improving the channel capacity of wireless systems.

Your feedback to us

One of the formal ways students have to provide feedback on teaching and their learning experience is through the Student Evaluation of Teaching and Units (SETU) survey. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied with and areas for improvement.

Previous student evaluations of this unit

In response to previous SETU results of this unit, the following changes have been made:

Need to revise the syllabus and start from the basics so that students can follow and relate to what they previously studied.

Student feedback has highlighted the following strength(s) in this unit:

The teaching staff are all very good and have clear explanations.

The content is well organised.

Overall this was a good unit.

If you wish to view how previous students rated this unit, please go to:
https://unitevaluations.connect.monash.edu.au/unitevaluations/index.jsp

Unit schedule

Week	Lectures Part A	Lectures Part B	Assessment Parts A&B
0		Introductory Lecture LabVIEW	No formal assessment is undertaken in week 0
1	Wireless channel modelling: Deterministic approach.	Lab 2 discussion Platform introduction Demonstrations	Quiz 1 based on key paper (Marzetta). Lab 1 due
2	Wireless channel modelling: Baseband and passband channel models.	Path loss (log-distance), SISO versus MIMO, RF system parameters, Direct conversion receiver info and more	Quiz 2 due
3	Wireless channel modelling: Stochastic channel model.	Wireless Channel and fading	Quiz 3 due Lab 2 due
4	Capacity of point-to-point channels without fading.	Digital communications, modulation demodulation, BER, source coding error detection	Quiz 4 due Assignment 1 due
5	Capacity of point-to-point wireless channels with full channel state information.	Pulse shaping & Matched Filtering-implementation	Quiz 5 due Lab 3 due
6	Capacity and outage probability of point-to-point wireless channels with partial channel state information.	Pulse shaping & Matched Filtering	Quiz 6 due
7	Capacity and outage probabilities of wireless channels with diversity.	Synchronization timing frame detection, frequency offset correction-implementation	Quiz 7 due Lab 4 due
8	MIMO wireless channel model.	Synchronization timing frame detection, frequency offset correction	Quiz 8 due Assignment 2 due
9	Capacity of MIMO wireless channels with full channel state information.	Channel estimation and equalisation	Quiz 9 due Lab 5 due

10	Capacity and outage probability of MIMO wireless channels with partial channel state information.	Channel estimation and equalisation	Quiz 10 due Lab 6 due
11	Multiuser wireless channels: Multiple-access channel.	OFDM implementation	Quiz 11 due
12	Multiuser wireless channels: Broadcast channel.		Quiz 12 due Lab 7 due Assignment 3 due
	SWOT VAC		
	Examination period		

Assessment requirements

Assessment summary

Continuous assessment: 50%
Examination (2 hours): 50%
Students are required to achieve at least 45% in the total continuous assessment component (assignments, tests, mid-semester exams, laboratory reports) and at least 45% in the final examination component and an overall mark of 50% to achieve a pass grade in the unit. Students failing to achieve this requirement will be given a maximum of 45% in the unit.

Assessment task	Value	Due date
Online Quizzes (X12)	5% (best 10 count, equally weighted)	Every Sunday evening of each week.
Lectorial participation (x12)	5%	Monday and Wednesday lectorials every week
Laboratory Reports (x6)	25% (equally weighted)	6:00pm Friday of Weeks 2, 4, 6, 8, 10 and 12
Assignments (x3)	15% (equally weighted)	6:00pm Friday of Weeks 4, 8 and 12
Final Exam	50%	To be advised

Assessment tasks

Assessment title: Online Quizzes (X12)
Mode of delivery: Online via Moodle.
Details of task: There will be 12 online quizzes, one due every week. Your best 10 quizzes only will count and will be worth 5% in total (so no need to worry if you miss one or two). Quizzes will be based on assigned pre-reading for the next lectorial, e.g. for next Monday's lecture you will be

asked to read sections of Chapter 2 in the textbook and then complete an online quiz on the topics covered by Sunday evening. Lectorials will run assuming you have completed the pre-reading.
Release dates (where applicable): Ongoing
Word limit (where applicable): Not applicable
Due date: Every Sunday evening of each week.
Value: 5% (best 10 count, equally weighted)
Presentation requirements: n/a
Hurdle requirements (where applicable): n/a
Individual assessment in group tasks (where applicable): n/a
Criteria for marking: Based on the answers. Out of 12, only the best 10 count, equally weighted.
Additional remarks: n/a

Assessment title: Lectorial participation (x12)
Mode of delivery: Clayton
Details of task: We expect you to attend the lectorials. A lectorial participation mark will be awarded based on your participation in lectorials throughout the semester. Participation includes turning up, asking questions and answering questions, and generally being engaged in the discussion. You will need to attend and actively participate in at least NINE Monday lectures and NINE Wednesday lectures to obtain full marks. This will be worth 5% toward your final mark.
Release dates (where applicable): n/a
Word limit (where applicable): n/a
Due date: Monday and Wednesday lectorials every week
Value: 5%
Presentation requirements: n/a
Hurdle requirements (where applicable): n/a
Individual assessment in group tasks (where applicable): n/a
Criteria for marking: Attend and participate in at least nine Monday and Wednesday lectorials for full marks. For less then nine participated lectorials, each participated lectorial on Monday is worth 10/27 percentage points and each participated lectorial on Wednesday is worth 5/27 percentage points.
Additional remarks: n/a

Assessment title: Laboratory Reports (x6)
Mode of delivery: Clayton
Details of task: Part B will involve completion of six ‘laboratory’ reports due in Weeks 2, 4, 6, 8, 10 and 12. All laboratory reports will have equal value. You will need access to the Software Defined Telecommunications Laboratory, G19, 16 Alliance Lane to complete the reports. It will be open for your use on Wednesdays 3:00pm to 6:00pm ,Thursdays 12:00pm to 3:00pm and 6:00pm to 9:00 pm.
Release dates (where applicable): n/a
Word limit (where applicable): n/a
Due date: 6:00pm Friday of Weeks 2, 4, 6, 8, 10 and 12
Value: 25% (equally weighted)
Presentation requirements: n/a
Hurdle requirements (where applicable): n/a
Individual assessment in group tasks (where applicable): n/a
Criteria for marking: Each completed laboratory report is equally weighted with 25/6 percentage points.
Additional remarks: n/a

Assessment title: Assignments (x3)
Mode of delivery: Online via Moodle.
Details of task: Part A of the lectorials will be divided into three sections. You will have one Assignment for each of these sections, due in Weeks 4, 8 and 12, and each worth 5%. Questions in the assignments will be similar in nature to what you can expect on the final exam (although sometimes the assignment questions will be longer and/or more difficult and/or involve some programming).
Release dates (where applicable): n/a
Word limit (where applicable): n/a
Due date: 6:00pm Friday of Weeks 4, 8 and 12
Value: 15% (equally weighted)
Presentation requirements: n/a
Hurdle requirements (where applicable): n/a
Individual assessment in group tasks (where applicable): n/a
Criteria for marking: Based on the answers.
Additional remarks: n/a

Examination(s)

Exam title: Final Exam
Weighting: 50%
Length: 2 hours
Type (Open/closed book): Closed book.
Hurdle requirements (where applicable): Students are required to achieve at least 45% in the final examination.
Electronic devices allowed: Electronic devices are not allowed.
Remarks (where applicable): Based (at least in part) on the lectures.

Calculators NOT permitted
Calculators are not permitted.

Returning assignments

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later.

Resubmission of assignments

Resubmission is not allowed, but late submission is allowed under extreme health or similar extreme situations on which student did not have any control.

Plagiarism and collusion

Intentional plagiarism or collusion amounts to cheating under Part 7 of the Monash University (Council) Regulations.

Plagiarism: Plagiarism means taking and using another person's ideas or manner of expressing them and passing them off as one's own. For example, by failing to give appropriate acknowledgement. The material used can be from any source (staff, students or the internet, published and unpublished works).

Collusion: Collusion means unauthorised collaboration with another person on assessable written, oral or practical work and includes paying another person to complete all or part of the work. Where there are reasonable grounds for believing that intentional plagiarism or collusion has occurred, this will be reported to the Associate Dean (Education) or delegate,

Referencing requirements

The Department of Electrical and Computer Systems Engineering uses the IEEE referencing standards. Please refer to the link below and click IEEE.

http://www.lib.monash.edu/tutorials/citing/ieee.html

To build your skills in citing and referencing, and using different referencing styles, see the online tutorial Academic Integrity: Demystifying Citing and Referencing atwww.lib.monash.edu.au/tutorials/citing/

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Assignment submission

Hard Copy Submission:

Assignments must include a cover sheet. The coversheet is accessible via the Monash portal page located at http://my.monash.edu.au under the heading 'Learning and teaching tools.' Please keep a copy of tasks completed for your records.

Online Submission: If Electronic Submission has been approved for your unit, please submit your work via the Moodle site or other; as directed by your demonstator for this unit.
Please keep a copy of tasks completed for your records.

If Electronic Submission has been approved for your unit, please submit your work via the Moodle site or other; as directed by your demonstator for this unit.

Feedback to you

You will receive feedback throughout the semester including: results from online quizzes, marks and written comments on laboratory reports, and marks and written comments on assignments. Useful feedback should also be derived from the interactive lectorials.

Learning resources

Prescribed textbooks

[1] David Tse and Pramod Viswanath, "*Fundamentals of wireless communication,*" Cambridge University Press, 2005.

[2] Andrea Goldsmith, "*Wireless communications,"* Cambridge University Press, 2005.

Monash Library Unit Reading List (if applicable to the unit):
http://readinglists.lib.monash.edu/index.html

Required resources

Students generally must be able to complete the requirements of their course without the imposition of fees that are additional to the student contribution amount or tuition fees. However, students may be charged certain incidental fees or be expected to make certain purchases to support their study. For more information about this, go to Administrative Information for Higher Education Providers: Student Support, Chapter 21, Incidental Fees at: http://www.innovation.gov.au/HigherEducation/TertiaryEducation/ResourcesAndPublications/Pages/default.aspx

Other information

Policies

Monash has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and to provide advice on how they might uphold them. You can find Monash's Education Policies at:
http://www.policy.monash.edu/policy-bank/academic/education/index.html

Graduate Attributes Policy

http://www.monash.edu/policy-bank/academic/education/course-governance-and-design/course-design-policy

Student Charter

http://www.monash.edu/students/policies/student-charter.html

Student Services

The University provides many different kinds of services to help you gain the most from your studies. Contact your tutor if you need advice and see the range of services available at: http://www.monash.edu/students

Monash University Library

The Monash University Library provides a range of services, resources and programs that enable you to save time and be more effective in your learning and research.
Go to http://www.monash.edu/library or the library tab in http://my.monash.edu.au portal for more information.

Disability Support Services

Students who have a disability, ongoing medical or mental health condition are welcome to contact Disability Support Services.

Disability Support Services also support students who are carers of a person who is aged and frail or has a disability, medical condition or mental health condition.

Disability Advisers visit all Victorian campuses on a regular basis.

- Website: monash.edu/disability
- Telephone: 03 9905 5704 to book an appointment with an Adviser;
- Email: disabilitysupportservices@monash.edu
- Drop In: Level 1, Western Annexe, 21 Chancellors Walk (Campus Centre) Clayton Campus