TELE4081

Digital Communication Systems

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Engineering

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
Hazer Inaltekin
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Contact via 9850 2280
44 WTR, Room 133
Monday 10am-11am

Credit points
10

Prerequisites
(Admission to MEngNetTeleEng) or (Admission to MEngElecEng) or (TELE3350)

Corequisites

Co-badged status
TELE8081

Unit description
This unit develops applied knowledge about computer-aided telecommunications system design and provides hands-on experience in performance management and optimisation analysis of modern and future telecommunications systems. It introduces Simulink models and teaches how to use these models in digital data transmission, pulse shaping over bandlimited channels, OFDM, fading channels, multi-antenna beamforming, multiuser wireless communications, satellite communications and optical communications. The key telecommunications engineering performance indicators such as bit error rates, spectrum utilisation, throughput, delay and diversity are studied in detail and they are gauged by means of software-defined probes attached to the telecommunications system components. The practical computer-aided signal processing and digital communications techniques to manage and optimise these key performance indicators are taught when transmitted data is corrupted by channel noise and fading.

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: Utilise Matlab and Simulink environment to design modern digital communication systems and characterise relevant system performance metrics.
ULO2: Demonstrate applied and theoretical understanding of fundamental signal processing and digital communication techniques to optimise telecommunication system performance.
ULO3: Articulate fundamental tradeoffs among key digital communication system performance indicators, e.g., bit error rate, capacity and delay, and main telecommunication resources such as power, frequency and space.
ULO4: Demonstrate proficiency in areas of professional engineering practice, including team work, self-motivation and self learning, production of quality work to meet a given deadline.

General Assessment Information

Grading and passing requirement for unit:

In order to pass this unit a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD).

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

Final examination:

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.

Late submissions and re-submissions:

The scheduled test and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.

All other assessments must be submitted by 5:00pm (Sydney Time) on their due date.

Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration.

Assessments not submitted by the due date will receive a mark of zero.

Workshops:

The on-campus workshops will commence in Week 2. If you are not able to get back to campus

on time, please contact with the unit convenor as soon as possible.

Assessment Tasks

Name	Weighting	Hurdle	Due
Final Exam	40%	No	Week 13
Weekly projects	30%	No	All Session
Mid-semester test	30%	Yes	Week 7

Final Exam

Assessment Type [1]: Viva/oral examination
Indicative Time on Task [2]: 20 hours
Due: **Week 13**
Weighting: **40%**

Oral examination at the end of the unit to test students' applied and theoretical understanding of digital communication systems.

On successful completion you will be able to:

- Utilise Matlab and Simulink environment to design modern digital communication systems and characterise relevant system performance metrics.
- Demonstrate applied and theoretical understanding of fundamental signal processing and digital communication techniques to optimise telecommunication system performance.
- Articulate fundamental tradeoffs among key digital communication system performance indicators, e.g., bit error rate, capacity and delay, and main telecommunication resources such as power, frequency and space.

Weekly projects

Assessment Type [1]: Project
Indicative Time on Task [2]: 40 hours
Due: **All Session**
Weighting: **30%**

Weekly projects that will focus on fundamental design principles for modern digital communication systems.

On successful completion you will be able to:

- Utilise Matlab and Simulink environment to design modern digital communication systems and characterise relevant system performance metrics.
- Demonstrate proficiency in areas of professional engineering practice, including team work, self-motivation and self learning, production of quality work to meet a given deadline.

Mid-semester test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 15 hours
Due: **Week 7**
Weighting: **30%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

In-class invigilated mid-semester test

On successful completion you will be able to:

- Demonstrate applied and theoretical understanding of fundamental signal processing and digital communication techniques to optimise telecommunication system performance.
- Articulate fundamental tradeoffs among key digital communication system performance indicators, e.g., bit error rate, capacity and delay, and main telecommunication resources such as power, frequency and space.

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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

Unit Delivery:

There is no required textbook in the unit. Necessary and sufficient material will be covered during the lectures and workshop hours.

The following open-source references on Matlab are highly recommended:

- *Communications Toolbox: Getting Started Guide*, MathWorks, 2018.
- *Communications Toolbox: User Guide*, MathWorks, 2018.

The unit will be project based and the emphasis on theory will be minimal. The following references are useful for some background material:

- *Communication Systems*, 5th ed., S. Haykin and M. Moher, John Wiley & Sons, 2009.
- *Modern Digital and Analog Communication Systems*, 4th ed., B. P. Lathi and Z. Ding, Oxford University Press, 2009.
- Principles of Digital Communication, 1st ed., R. G. Gallager, Cambridge University Press, 2008.

Software:

Matlab (2019b or above) & Simulink by MathWorks are required. The required software will be available in the workshop computers. It can also be downloaded for home installation after registering for an online account with MathWorks - mathworks.com. For more information, please see:

https://staff.mq.edu.au/intranet/science-and-engineering/services-and-resources/it-support-services/miscellaneous/matlab

Unit Web Page:

Unit lecture notes, resources and other information about the unit can be accessed through iLearn.

Technology Used:

The primary software tool used in workshops is Matlab/Simulink. In addition to Matlab, standard library/internet search engines and word processing software will be used.

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
- Assessment Procedure
- Complaints Resolution 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

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity

- Complete the 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

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues

Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

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.

Engineers Australia Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO2
	1.3 In-depth understanding of specialist bodies of knowledge	ULO2
	1.4 Discernment of knowledge development and research directions	
	1.5 Knowledge of engineering design practice	ULO3

	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	ULO3
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO2, ULO3
	2.2 Fluent application of engineering techniques, tools and resources.	ULO1, ULO2
	2.3 Application of systematic engineering synthesis and design processes.	
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	ULO3
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	
	3.2 Effective oral and written communication in professional and lay domains.	ULO4
	3.3 Creative, innovative and pro-active demeanour.	
	3.4 Professional use and management of information.	ULO4
	3.5 Orderly management of self, and professional conduct.	ULO4
	3.6 Effective team membership and team leadership	ULO4