

ELEC3540: Analog and Digital Communications

Callaghan

Semester 2 - 2023



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

OVERVIEW

Course Description

This course introduces you to the basic principles and techniques used in analog and digital communications. You will learn analog and digital modulation techniques, communication receiver and transmitter design, baseband and bandpass communication techniques, line coding techniques, and noise analysis in various transmission environments. After completing the course, you will be able to use analytical techniques to evaluate the performance of analog and digital communication systems.

Assumed Knowledge

ELEC2430, STAT2110

Contact Hours

Laboratory

Face to Face On Campus
2 hour(s) per Week for 5 Weeks

Lecture

Face to Face On Campus
3 hour(s) per Week for Full Term

Tutorial

Face to Face On Campus
1 hour(s) per Week for 12 Weeks starting Week 2

Unit Weighting

10

Workload

Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

COURSE OUTLINE

CONTACTS

Course Coordinator	Callaghan A/Pr Duy Ngo Duy.Ngo@newcastle.edu.au (02) 4921 8947 Consultation: See the course Canvas site.
Teaching Staff	Other teaching staff will be advised on the course Canvas site.
School Office	School of Engineering EAG03 EA Building Callaghan +61 2 4921 5798 9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday)

SYLLABUS

Course Content	<ol style="list-style-type: none">1. Basic elements of a communication system2. Deterministic signal characterisation and analysis3. Review of probability theory, random variables and random processes4. Analog modulation and demodulation techniques: AM, FM5. Sampling and quantisation6. Optimum receiver for binary data transmission7. Baseband data transmission and line coding techniques8. Basic digital passband modulation and demodulation techniques: BASK, BPSK, BFSK, QPSK, OQPSK, MSK9. M-ary signalling techniques10. Signalling over bandlimited channels11. Synchronisation
Course Learning Outcomes	<p>On successful completion of this course, students will be able to:</p> <ol style="list-style-type: none">1. Identify the basic elements of a communication system2. Analyse baseband signals in time domain and in frequency domain3. Compare and contrast various analog and digital modulation and demodulation techniques4. Evaluate the performance of modulation and demodulation techniques in various transmission environments5. Explain the importance of synchronisation in communication systems
Course Materials	<p>Lecture Materials:</p> <ul style="list-style-type: none">- Lecture notes, Tutorial problems, Lab handouts, Assignments: Will be posted on the course Canvas site. Please note that the textbook and lecture notes cannot substitute active participation in the lectures and tutorials. For your success in this course, it is essential that you attend all lectures and tutorials and actively take notes. <p>Required Text:</p> <ul style="list-style-type: none">- Ha H. Nguyen and Ed Shwedyk. <i>A First Course in Digital Communications</i>. 1st edition. Cambridge: Cambridge University Press, 2009 (ISBN: 9780521876131).

ASSESSMENTS

This course has 3 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Laboratory Exercises and Written Assignments		Individual	35%	1, 2, 3, 4
2	Examination: Formal	During university exam period	Individual	50%	1, 2, 3, 4, 5
3	Quiz - Class	To be held during regular lecture hours in Week 7.	Individual	15%	1, 2, 3

Late Submissions

The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Laboratory Exercises and Written Assignments

Assessment Type	Tutorial / Laboratory Exercises
Description	
Weighting	35%
Due Date	
Submission Method	Online
Assessment Criteria	
Return Method	In Class Online
Feedback Provided	

Assessment 2 - Examination: Formal

Assessment Type	Formal Examination
Description	There is a restricted open-book final examination.
Weighting	50%
Length	2 hours
Due Date	During university exam period
Submission Method	Formal Exam
Assessment Criteria	
Return Method	Not Returned
Feedback Provided	

Assessment 3 - Quiz - Class

Assessment Type	Quiz
Description	There is one in-class quiz. Hand-held non-programmable calculators are permitted.
Weighting	15%
Length	To be announced
Due Date	To be held during regular lecture hours in Week 7.
Submission Method	In Class
Assessment Criteria	
Return Method	In Class School Office
Feedback Provided	

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

Attendance

*Skills are those identified for the purposes of assessment task(s).

Attendance/participation will be recorded in the following components:

- Laboratory (Method of recording: Signing an attendance sheet)

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

Students are strongly advised to regularly check the course Canvas site and their UON student email account.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the [Oral Examination \(viva\) Procedure](#). In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the [Student Conduct Rule](#).

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to <https://policies.newcastle.edu.au/document/view-current.php?id=35>.

Adverse

The University acknowledges the right of students to seek consideration for the impact of

Circumstances

allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:

<https://policies.newcastle.edu.au/document/view-current.php?id=236>

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at

<https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures> that support a safe and respectful environment at the University.

Graduate Profile Statements

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability				
12	3.2. Effective oral and written communication in professional and lay domains.	☑	☑	☑	1,2
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.				
15	3.5. Orderly management of self, and professional conduct.				
16	3.6. Effective team membership and team leadership.				
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	☑	☑	☑	1,2
8	2.2. Fluent application of engineering techniques, tools and resources.	☑	☑	☑	1,2
9	2.3. Application of systematic engineering synthesis and design processes.				
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.				
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	☑	☑		1,2
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.	☑	☑		1,2
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	☑	☑	☑	1,2
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.	☑	☑	☑	1,2
5	1.5. Knowledge of contextual factors impacting the engineering discipline.				
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.				

This course outline was approved by the Head of School on 04/07/2023. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

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