UNSW Course Outline

ZEIT3218 Communication Systems - 2024

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General Course Information

Course Code : ZEIT3218
Year : 2024
Term : Semester 2
Teaching Period : Z2
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : School of Engineering and Technology
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

The focus of this course is on developing principles and tools for the design and analysis of communication systems. The course builds upon principles and tools for the analysis of signals and systems learned in ZEIT3215 Signals and Systems, including Fourier Series and Fourier

Transform and their properties. The course covers the analysis of the theory and the associated practical issues in the design of AM and FM transmitters and receivers, analysis of baseband line coding schemes and their properties, analysis and design of passband digital modulation and demodulation schemes, Maximum Likelihood detection scheme and error rate analysis of different modulations. In addition, the application of these concepts to the design and implementation of modern communication systems is covered.

Course Aims

The course aims to provide the basic tools to analyse and design communication systems and assess their performance in the presence of noise and other sources of degradation (e.g. multipath).

Relationship to Other Courses

This course requires the completion of the following prerequisites: ZEIT3215 and ZPEM2310.

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Analyse different analogue modulation and demodulation schemes (i.e., AM, FM, PM).	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.2 : Fluent application of engineering techniques, tools and resources
CLO2 : Analyse the theory and the associated practical issues in the design of AM and FM transmitters and receivers.	• PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.3 : Application of systematic engineering synthesis and design processes
CLO3 : Analyse baseband line coding schemes and their properties, including their power spectral densities.	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving
CLO4 : Analyse passband digital modulation and demodulation schemes (i.e., PSK, PAM, QAM).	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving
CLO5 : Analyse Maximum Likelihood detection scheme and the error rate (BER and SER) of different modulations.	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.2 : Fluent application of engineering

	techniques, tools and resources
CLO6 : Apply the learned concepts to the design and implementation of communication systems.	• PEE2.3 : Application of systematic engineering synthesis and design processes • PEE2.4 : Application of systematic approaches to the conduct and management of projects within the technology domain • PEE3.1 : Ethical conduct and professional accountability • PEE3.4 : Professional use and management of information • PEE3.6 : Effective team membership and team leadership

Course Learning Outcomes	Assessment Item
CLO1 : Analyse different analogue modulation and demodulation schemes (i.e., AM, FM, PM).	• Laboratory Reports • Class Tests • Final Examination
CLO2 : Analyse the theory and the associated practical issues in the design of AM and FM transmitters and receivers.	• Laboratory Reports • Class Tests • Final Examination
CLO3 : Analyse baseband line coding schemes and their properties, including their power spectral densities.	• Laboratory Reports • Class Tests • Final Examination
CLO4 : Analyse passband digital modulation and demodulation schemes (i.e., PSK, PAM, QAM).	• Laboratory Reports • Class Tests • Final Examination
CLO5 : Analyse Maximum Likelihood detection scheme and the error rate (BER and SER) of different modulations.	• Laboratory Reports • Final Examination
CLO6 : Apply the learned concepts to the design and implementation of communication systems.	• Laboratory Reports • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

The Learning Management System

Moodle is the Learning Management System used at UNSW Canberra. All courses have a Moodle site which will become available to students at least one week before the start of semester. Please find all help and documentation (including Blackboard Collaborate) at the Moodle

Support page.

UNSW Moodle supports the following web browsers:

» Google Chrome 50+
» Safari 10+
** Internet Explorer is not recommended

** Addons and Toolbars can affect any browser's performance.

Operating systems recommended are:

Windows 7, 10, Mac OSX Sierra, iPad IOS10

For further details about system requirements click here.

Log in to Moodle here.

If you need further assistance with Moodle:

For enrolment and login issues please contact:
IT Service Centre
Email: itservicecentre@unsw.edu.au
Phone: (02) 9385-1333
International: +61 2 9385 1333

For all other Moodle issues please contact:
External TELT Support
Email: externalteltsupport@unsw.edu.au
Phone: (02) 9385-3331
International: +61 2 938 53331

Opening hours:
Monday – Friday 7:30am – 9:30 pm
Saturday & Sunday 8:30 am – 4:30pm

Other Professional Outcomes

Mapping to Program Learning Outcomes

This course contributes to the following Program Learning Outcomes of the Bachelor of

Engineering (Hons) (Electrical Engineering).

1. Students will be able to relate a quantitative, theory-based understanding of the sciences and fundamentals of electrical engineering (encompassing circuit analysis and design, signal processing, dynamical systems, control, power systems and communications).

2. Students will be able to appropriately select and apply the mathematical, statistical, programming and computational tools and techniques which underpin electrical engineering.

3. Students will demonstrate a comprehensive understanding of electrical systems and components, and articulate directions of future research and knowledge development in electrical engineering.

5. Students will define, conduct experiments on and analyse complex, open-ended problems and apply appropriate methods for their solution.

6. Students will demonstrate proficiency in applying systematic engineering synthesis and design processes, and critically evaluating and effectively communicating the results and implications to all audiences.

7. Students will be able to operate in collaborative environments, as leader or member of interdisciplinary teams.

Additional Course Information

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Plagiarism undermines academic integrity and is not tolerated at UNSW. *It is defined as using the words or ideas of others and passing them off as your own, and* can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

https://student.unsw.edu.au/plagiarism

Referencing

In this course, students are required to reference following the APA 7 / Chicago NB referencing style. Information about referencing styles is available at: https://guides.lib.unsw.adfa.edu.au/c.php?g=472948&p=3246720

Study at UNSW Canberra

https://www.unsw.adfa.edu.au/study

Study at UNSW Canberra has lots of useful information regarding:

- Where to get help
- Administrative matters
- Getting your passwords set up
- How to log on to Moodle
- Accessing the Library and other areas.

Additional Information as required

CRICOS Provider no. 00098G

The University of New South Wales Canberra.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Engineers Australia - Professional Engineer (Stage 1)
Laboratory Reports Assessment Format: Individual Short Extension: Yes (2 days)	24%	Start Date: Not Applicable Due Date: Not Applicable	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.2 : Fluent application of engineering techniques, tools and resources • PEE2.3 : Application of systematic engineering synthesis and design processes • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE3.5 : Orderly management of self, and professional conduct
Class Tests Assessment Format: Individual	31%	Start Date: Not Applicable Due Date: Not Applicable	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.2 : Fluent application of engineering techniques, tools and resources • PEE2.3 : Application of systematic engineering synthesis and design processes • PEE3.2 : Effective oral and written communication in professional and lay domains

Final Examination Assessment Format: Individual	45%		• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.2 : Fluent application of engineering techniques, tools and resources • PEE2.3 : Application of systematic engineering synthesis and design processes • PEE3.2 : Effective oral and written communication in professional and lay domains

Assessment Details

Laboratory Reports

Assessment Overview

Lab Reports

Course Learning Outcomes

- CLO1 : Analyse different analogue modulation and demodulation schemes (i.e., AM, FM, PM).
- CLO2 : Analyse the theory and the associated practical issues in the design of AM and FM transmitters and receivers.
- CLO3 : Analyse baseband line coding schemes and their properties, including their power spectral densities.
- CLO4 : Analyse passband digital modulation and demodulation schemes (i.e., PSK, PAM, QAM).
- CLO5 : Analyse Maximum Likelihood detection scheme and the error rate (BER and SER) of different modulations.
- CLO6 : Apply the learned concepts to the design and implementation of communication systems.

Detailed Assessment Description

The course includes four comprehensive laboratory exercises designed to enhance your

understanding and application of key concepts:

- **Lab 1:** Amplitude Modulation and Demodulation
- **Lab 2:** Frequency Modulation and Demodulation
- **Lab 3:** BPSK and QPSK Modulations
- **Lab 4:** QPSK Detection

These laboratory exercises span several weeks and are scheduled during the weekly 2-hour lab sessions held in the Electrical Engineering Teaching Laboratories (Rooms 114/116, Building 16). You are required to submit detailed Lab Reports upon the completion of each lab activity (Lab 1, Lab 2, Lab 3, and Lab 4). These reports will allow you to demonstrate your grasp of the material and integrate various concepts and techniques covered throughout this course.

Lab Report Submission Deadlines:

- **Lab 1 (6%)** - Due by Friday, 9 August 2024 at 23:59
- **Lab 2 (6%)** - Due by Sunday, 15 September 2024 at 23:59
- **Lab 3 (6%)** - Due by Sunday, 13 October 2024 at 23:59
- **Lab 4 (6%)** - Due by Friday, 25 October 2024 at 23:59

Assessment Length

No longer than 10 pages.

Submission notes

Online via Moodle

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Class Tests

Assessment Overview

Class Tests

Course Learning Outcomes

- CLO1 : Analyse different analogue modulation and demodulation schemes (i.e., AM, FM, PM).
- CLO2 : Analyse the theory and the associated practical issues in the design of AM and FM transmitters and receivers.
- CLO3 : Analyse baseband line coding schemes and their properties, including their power spectral densities.
- CLO4 : Analyse passband digital modulation and demodulation schemes (i.e., PSK, PAM, QAM).

Detailed Assessment Description

Class tests will be conducted during lecture hours to assess the material covered up to that point. These assessments are closed-book and must be taken in person.

- **Class Test 1 (6%)** - 30 July 2024
- **Class Test 2 (10%)** - 20 August 2024
- **Class Test 3 (15%)** - 15 October 2024

Submission notes

In-class tests during lecture hours

Assessment information

This is a closed book assessment.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final Examination

Assessment Overview

Final Exam

Course Learning Outcomes

- CLO1 : Analyse different analogue modulation and demodulation schemes (i.e., AM, FM, PM).
- CLO2 : Analyse the theory and the associated practical issues in the design of AM and FM transmitters and receivers.
- CLO3 : Analyse baseband line coding schemes and their properties, including their power spectral densities.
- CLO4 : Analyse passband digital modulation and demodulation schemes (i.e., PSK, PAM, QAM).
- CLO5 : Analyse Maximum Likelihood detection scheme and the error rate (BER and SER) of different modulations.
- CLO6 : Apply the learned concepts to the design and implementation of communication systems.

Detailed Assessment Description

This is the final assessment, scheduled during the exam week. It is a closed-book exam lasting 2 hours and evaluates all class material.

Assessment Length

2 hours.

Submission notes

In person, hand written.

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

Class Test 1 will be held in Week 3. Students will receive written feedback for Class Test 1 during Week 4.

Late Submission of Assessment

Unless prior arrangement is made with the lecturer or a formal application for special consideration is submitted, a penalty of 5% of the total available mark for the assessment will apply for each day that an assessment item is late up to a maximum of 5 days (120 hours) after which an assessment can no longer be submitted and a grade of 0 will be applied.

Use of Generative AI in Assessments

- **Class Tests: No Assistance**
- **Lab Reports: Simple Editing Assistance**- Students are permitted to use standard editing and referencing software, but not Generative AI. You may use the full capabilities of standard software (e.g., Microsoft Office suite, Grammarly, etc.) to answer the question. The use of generative AI, such as ChatGPT, is considered serious academic misconduct and will be subject to standard penalties, which may include a grade of 00FL, suspension, and exclusion.
- **Exam: No Assistance**

Grading Basis

Standard

Requirements to pass course

In order to satisfactorily complete this course, students must achieve an overall mark of 50% or greater in the course assessment.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 15 July - 19 July	Lecture	Introduction to Communication Systems. Review of Fourier Series and Fourier Transform. Introduction to Modulation.
	Tutorial	Introduction to Communication Systems. Review of Fourier Series and Fourier Transform. Introduction to Modulation.
	Laboratory	Lab 1: Amplitude Modulation and Demodulation
Week 2 : 22 July - 26 July	Lecture	Amplitude Modulation: DSB-SC and DSB-TC.
	Tutorial	Amplitude Modulation: DSB-SC and DSB-TC.
	Laboratory	Lab 1: Amplitude Modulation and Demodulation.
Week 3 : 29 July - 2 August	Lecture	Modulators and Demodulators (SSB and VSB).
	Tutorial	Modulators and Demodulators (SSB and VSB).
	Laboratory	Lab 1: Amplitude Modulation and Demodulation
	Assessment	Class Test 1 during the lecture hours.
Week 4 : 5 August - 9 August	Lecture	Frequency Modulation: Narrowband FM and Wideband FM. Phase Modulation. FM Modulators and Demodulators.
	Tutorial	Frequency Modulation: Narrowband FM and Wideband FM. Phase Modulation. FM Modulators and Demodulators.
	Laboratory	Lab 2: Frequency Modulation and Demodulation
	Assessment	Lab 1 Report
Week 5 : 12 August - 16 August	Lecture	Noise in FM systems, Preemphasis and Deemphasis. The lecture on Tuesday, 13 August is lost.
	Tutorial	Noise in FM systems, Preemphasis and Deemphasis.
	Laboratory	Lab 2: Frequency Modulation and Demodulation.
Week 6 : 19 August - 23 August	Lecture	Multi-Signal Transmission, Transmitters and Receivers, Frequency-Division Multiplexing, Quadrature Multiplexing, and Superheterodyne Receiver.
	Tutorial	Multi-Signal Transmission, Transmitters and Receivers, Frequency-Division Multiplexing, Quadrature Multiplexing, and Superheterodyne Receiver.
	Laboratory	Lab 2: Frequency Modulation and Demodulation
	Assessment	Class Test 2 during the lecture hours.
Week 7 : 9 September - 13 September	Lecture	Introduction of digital communication systems. Line coding schemes.
	Tutorial	Introduction of digital communication systems. Line coding schemes.
	Assessment	Lab 2 Report - Due by Sunday, 15 September 2024 at 23:59.
Week 8 : 16 September - 20 September	Lecture	Signal Space analysis.
	Tutorial	Signal Space analysis.
	Laboratory	Digital signals and line coding.
Week 9 : 23 September - 27 September	Lecture	PASK, BPSK, BFSK modulation schemes, QPSK, M-ary PSK Modulation.
	Tutorial	PASK, BPSK, BFSK modulation schemes, QPSK, M-ary PSK Modulation.
Week 10 : 30 September - 4 October	Lecture	Gray Mapping, Pulse Amplitude Modulation (PAM), Quadrature Amplitude Modulation (QAM).
	Tutorial	Gray Mapping, Pulse Amplitude Modulation (PAM), Quadrature Amplitude Modulation (QAM).
	Laboratory	Lab 3: BPSK and QPSK Modulations.
Week 11 : 7 October - 11 October	Lecture	Correlator Demodulator, Maximum Likelihood Detection. (Monday Lecture Lost due to public Holiday).
	Assessment	Lab 3 Report.
Week 12 : 14 October - 18 October	Lecture	BER and SER analysis.
	Tutorial	Correlator Demodulator, Maximum Likelihood Detection.
	Laboratory	Lab 4: QPSK Detection.
	Assessment	Class Test 3 during the lecture hours.
Week 13 : 21 October - 25 October	Lecture	Revision.

	Tutorial	BER and SER analysis.
	Laboratory	Lab 4: QPSK Detection.
	Assessment	Lab 4 Report.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The following days are missed:

- **Compensation Day:** Friday, 16 August classes will be delivered on Tuesday, 13 August. Tuesday, 13 August classes are lost.
- **Labour Day:** Monday, 7 October - Monday classes are lost.
- **Military Training Day:** Thursday, 10 October - Thursday classes are lost.
- **Military Training Day:** Friday, 11 October - Friday classes are lost.

Course Resources

Prescribed Resources

B.P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 4th Ed., Oxford University Press

Bernard Sklar, Digital Communications: Fundamentals and Applications, 3rd Ed., Pearson.

Simon Haykin, Communication Systems, 5th Ed., John Wiley and Sons.

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do make a difference. Refer to the Moodle site for this course to see how the feedback from previous students has contributed to the course development.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct Policy

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Neda Abou torab		Building 17, Room 201A		Thursday, 2-3 pm. Please email to make an appointment for this time or any other time.	Yes	Yes
Lecturer	Khalil As' ham		Building 15, Room G01		Thursday, 2-3 pm. Please email to make an appointment for this time or any other time.	No	No