UNSW Course Outline

ZEIT3215 Signals and Systems - 2024

Published on the 13 Feb 2024

General Course Information

Course Code : ZEIT3215
Year : 2024
Term : Semester 1
Teaching Period : Z1
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

This course introduces descriptions of basic continuous and discrete time signals. It introduces the delta-impulse signal and its properties. Continuous-time and discrete-time systems and their properties are discussed. The convolution operation and linear system impulse response are

introduced. The course presents an analysis of signals using Fourier series and Fourier transform. Properties of the Fourier transforms, Fourier spectrum and power spectrum, Parseval's theorem, energy spectral density and power spectral density are presented. An application of these transforms in sampling theory is discussed. The tool of Laplace transforms and the methods of partial fraction expansions are discussed, including the concepts of transfer functions. These tools are applied in the analysis of active filters. The course also introduces computer aided analysis of analog linear systems.

Course Aims

This course aims to introduce fundamental concepts of frequency and time domain duality, transforms, causality, spectra, impulse and step response system characteristics which will feed other courses in communications, image and signal processing, design and control.

Relationship to Other Courses

This course requires the completion of the following prerequisite courses: ZEIT2207 and ZPEM2309.

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Engineering Technologist (Stage 1), Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Analysis of systems and signals in the time domain: By the end of the course, students will be able to identify and quantify properties and characteristics of continuous- and discrete time signals such as periodicity, energy and average power. They will be able to construct sampled signals and simple antialiasing and signal reconstruction filters. Students will also be able to analyze fundamental time-domain properties of systems such as linearity/nonlinearity, causality, time-invariance, and stability; determine and analyse characteristics of linear-time invariant systems such as impulse and step response and determine system response to other inputs using the operation of convolution.	• ET2.1 : Application of established engineering methods to broadly-defined problem solving within the technology domain • ET2.3 : Application of systematic synthesis and design processes within the technology domain • ET3.2 : Effective oral and written communication in professional and lay domains • PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE2.3 : Application of systematic engineering synthesis and design processes • PEE3.1 : Ethical conduct and professional accountability • PEE3.4 : Professional use and management of information
CLO2 : Analysis of systems and signals in the frequency domain: By the end of the course, students will be able to analyze frequency domain spectra of signals and systems using techniques based on integral and series transforms; determine and analyse characteristics of linear-time invariant systems such as transfer function and frequency response; analyze properties of linear-time- invariant systems based on poles and zeros of their transfer functions; analyze and synthesize simple systems such as filters to desired performance specifications.	• ET1.2 : Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the technology domain • ET1.3 : In-depth understanding of specialist bodies of knowledge within the technology domain • ET2.1 : Application of established engineering methods to broadly-defined problem solving within the technology domain • ET2.3 : Application of systematic synthesis and design processes within the technology domain • PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE3.4 : Professional use and management of information
CLO3 : After completing the course, students will be able to demonstrate their competency in the course material by solving problems in the area of signals and systems within the	• ET1.2 : Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the technology domain

scope set by the lecturer. Mastering signals and systems analysis tools such as Matlab and LTSpice is one of the practical outcomes to mention.	• ET1.3 : In-depth understanding of specialist bodies of knowledge within the technology domain • ET3.1 : Ethical conduct and professional accountability • ET3.3 : Creative, innovative and pro-active demeanour • PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE3.1 : Ethical conduct and professional accountability • PEE3.2 : Effective oral and written communication in professional and lay domains

Course Learning Outcomes	Assessment Item
CLO1 : Analysis of systems and signals in the time domain: By the end of the course, students will be able to identify and quantify properties and characteristics of continuous- and discrete time signals such as periodicity, energy and average power. They will be able to construct sampled signals and simple antialiasing and signal reconstruction filters. Students will also be able to analyze fundamental time-domain properties of systems such as linearity/nonlinearity, causality, time-invariance, and stability; determine and analyse characteristics of linear-time invariant systems such as impulse and step response and determine system response to other inputs using the operation of convolution.	
CLO2 : Analysis of systems and signals in the frequency domain: By the end of the course, students will be able to analyze frequency domain spectra of signals and systems using techniques based on integral and series transforms; determine and analyse characteristics of linear-time invariant systems such as transfer function and frequency response; analyze properties of linear-time- invariant systems based on poles and zeros of their transfer functions; analyze and synthesize simple systems such as filters to desired performance specifications.	
CLO3 : After completing the course, students will be able to demonstrate their competency in the course material by solving problems in the area of signals and systems within the scope set by the lecturer. Mastering signals and systems analysis tools such as Matlab and LTSpice is one of the practical outcomes to mention.	

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

Encouraging your participation and diligence will be the main strategy used in the teaching of this course. Apart from regular lectures, each student must attend a 1-hour tutorial each week and a set number of laboratory hours. The aim of the tutorial and labs is to encourage students' active individual learning so that a good understanding of the subject matter can be achieved. The lectures will cover principles and approaches of signals and systems analysis theory and set guidelines for further individual work.

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

This course aims to develop knowledge and technical proficiency in the analysis of genera signals and systems. The ability to characterize, analyse and manipulate systems and signals in time and frequency domains are the key learning outcomes of this course. Students will demonstrate their achievements in the course by attempting and solving homework, assignment, and in-class exercises and completing laboratory work.

Additional Course Information

The intention of this 6UoC course is to build on the mathematical concepts introduced in the Maths courses, introducing them in an engineering context. The knowledge of these mathematical concepts and tools introduced in those courses and Circuit Theory presented in Electronic Circuit and Analog Electronics courses are essential and constitute assumed knowledge. The objective of this course is to introduce fundamental concepts of operations on signals, frequency and time domain duality and transforms, signals spectra, and systems characteristics such as causality, time invariance, impulse, and step response, and frequency response which will feed other courses in communications, image and signal processing, design and control.

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.

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

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Engineers Australia - Professional Engineer (Stage 1)
Class Test (x2) Assessment Format: Individual	10%	Due Date: should be submitted on the date of the test	• 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
Final Exam Assessment Format: Individual	40%	Due Date: exam week	• 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 • PEE3.2 : Effective oral and written communication in professional and lay domains
Lab Reports (x4) Assessment Format: Individual	50%	Start Date: 26/02/2024 12:00 AM Due Date: The deadline of submission is specified in the schedule	• 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

Assessment Details

Class Test (x2)

Assessment Overview

Two Class Tests, worth 5% each

Detailed Assessment Description

Class test will be taken place duirng the lectures hours, assessing the delivered material to date. This is a closed book assessement and should be taken in person.

Class Test 1 (5%) - 13 March 2024

Class Test 2 (5%) - 15 May 2024

Assessment Length

1 hour duration

Submission notes

In class test during lecture hours

Assessment information

This is a closed book assessment.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final Exam

Assessment Overview

n/a

Detailed Assessment Description

This is the final assessment during the exam week. It is a closed book exam for 3 hours, testing the whole course material.

Assessment Length

3 hours

Submission notes

In person, hand written

Assessment information

This is a closed-book exam, covering the whhole course material.

Assignment submission Turnitin type

This is not a Turnitin assignment

Lab Reports (x4)

Assessment Overview

4 Lab Reports worth the following:
- Lab 1 (10%)
- Lab 2 (15%)
- Lab 3 (10%)
- Lab 4 (15%)

Detailed Assessment Description

Lab individual reports for each unit, maximum of 10 pages.

Lab 1 report (10%) - 22 March 2024

Lab 2 report (15%) - 3 May 2024

Lab 3 report (10%) - 24 May 2024

Lab 4 report (15%) - 7 June 2024

Assessment Length

10 pages max each report

Submission notes

online via Moodle

Assessment information

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.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

General Assessment Information

Students will get the written feedback of Assignment 1 (Class Test 1) by the census date (24 March).

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

Simple Editing Assistance - Students are permitted to use standard editing and referencing software, but not Generative AI.

You are permitted to use the full capabilities of the standard software to answer the question (e.g. you may wish to specify particular software such as Microsoft Office suite, Grammarly, etc.).

If the use of generative AI such as ChatGPT is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.

Grading Basis

Standard

Requirements to pass course

In order to pass the course, students must achieve an overall mark of 50% in the course assessment.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	Signals in the time domain Andrey Miroshnichenko
	Tutorial	Signals in the time domain Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 1 Andrey Miroshnichenko and Khalil As'ham
Week 2 : 4 March - 8 March	Lecture	Signals in the frequency domain Andrey Miroshnichenko
	Tutorial	Signals in the frequency domain Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab1 Andrey Miroshnichenko and Khalil As'ham
Week 3 : 11 March - 15 March	Lecture	Sampling theorem Andrey Miroshnichenko
	Tutorial	Sampling theorem Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 1 Andrey Miroshnichenko and Khalil As'ham
	Assessment	Class Test 1 assessemnt during the lecture hours
Week 4 : 18 March - 22 March	Lecture	Systems in the time domain Andrey Miroshnichenko
	Tutorial	Systems in the time domain Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 2 Andrey Miroshnichenko and Khalil As'ham
	Assessment	Lab 1 report is due.
Week 5 : 25 March - 29 March	Lecture	Systems in the frequency domain Andrey Miroshnichenko
	Laboratory	Lab 2 Andrey Miroshnichenko and Khalil As'ham
Week 6 : 1 April - 5 April	Lecture	Analysis and design of filters, part 1 Andrey Miroshnichenko
	Tutorial	Analysis and design of filters, part 1 Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 2 Andrey Miroshnichenko and Khalil As'ham
Week 7 : 22 April - 26 April	Tutorial	Analysis and design of filters Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 3 Andrey Miroshnichenko and Khalil As'ham
Week 8 : 29 April - 3 May	Lecture	Analysis and design of filters, part 2 Andrey Miroshnichenko
	Tutorial	Analysis and design of filters, part 2 Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 3 Andrey Miroshnichenko and Khalil As'ham
	Assessment	Lab 2 report is due
Week 9 : 6 May - 10 May	Lecture	Oscillators Andrey Miroshnichenko
	Tutorial	Oscillators Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 3 Andrey Miroshnichenko and Khalil As'ham
Week 10 : 13 May - 17 May	Lecture	Root locus analysis Andrey Miroshnichenko
	Tutorial	Root locus analysis Andrey Miroshnichenko and Khalil As'ham

	Laboratory	Lab 4 Andrey Miroshnichenko and Khalil As'ham
	Assessment	Class Test 2 during the lecture hour
Week 11 : 20 May - 24 May	Lecture	Transient and steady-state errors Andrey Miroshnichenko
	Tutorial	Transient and steady-state errors Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 4 Andrey Miroshnichenko and Khalil As'ham
	Assessment	Lab 3 report is due
Week 12 : 27 May - 31 May	Lecture	Control – design via root locus Andrey Miroshnichenko
	Tutorial	Control – design via root locus Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 4 Andrey Miroshnichenko and Khalil As'ham
Week 13 : 3 June - 7 June	Lecture	Revision Andrey Miroshnichenko
	Tutorial	Revision Andrey Miroshnichenko and Khalil As'ham
	Laboratory	Lab 4 Andrey Miroshnichenko and Khalil As'ham
	Assessment	Lab 4 report is due

Attendance Requirements

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

General Schedule Information

There will be 1 two-hour lecture, 1 one-hour tutorial and 1 three-hour labs per week.

Course Resources

Prescribed Resources

1. M.J. Roberts, Signals and Systems: Analysis using transform methods and Matlab, McGraw Hill, 2018.

2. N. Nise, Control Systems Engineering, Wiley, 2014

Recommended Resources

T. Floyd, Electronic Devices: Electron Flow Version, Pearson, 2018

Additional Costs

During the lab activities, students will be using Moku:Go equipment install in the EE lab. Alternately, students can use Analog Discovery 2/3 devices, which are not provided in this course.

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	Andrey Mirosh nichenko				by appointemnt	No	Yes
Demonstrator	Khalil As'Ham				by appointment	No	No

Other Useful Information

Academic Information

Course Evaluation and Development

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feedback from previous students has contributed to the course development.

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

Equitable Learning Services (ELS)

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitible Learning Services team. Equitable Learning Services is a free and confidential service that provides practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators** (ELFs) are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: https://www.student.unsw.edu.au/equitable-learning

Academic Honesty and Plagarism

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. Find relevant information at: Student Code of Conduct (unsw.edu.au)

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

Submission of Assessment Tasks

Special Consideration

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:

(i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or

(ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: https://www.student.unsw.edu.au/special/consideration/guide

Or apply for special consideration through your MyUNSW portal.

Late Submission of assessment tasks (other than examinations)

UNSW has a standard late submission penalty of:

- 5% per day,

- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Electronic submission of assessment

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

Release of final mark

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is the only official mark.