EE3210: SIGNALS AND SYSTEMS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Signals and Systems

Subject Code
EE - Electrical Engineering
Course Number
3210

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA1201 Calculus and Basic Linear Algebra II
or
MA1301 Enhanced Calculus and Linear Algebra II
or
EE1002 Principles of Electrical Engineering (Only applicable from 2021/22 and thereafter)

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

Students will gain a solid understanding of the fundamental concepts and tools vital for the analysis of signals and systems. In addition, they will acquire foundational knowledge and skills that are applicable across a broad spectrum of scientific and engineering disciplines, including but not limited to communications, control, and signal processing.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain different types of signals and systems, along with their properties in both continuous-time and discrete-time domains.	20	x	x	
2	Explain and apply signal transform across different domains.	35	x	x	
3	Discuss and analyze the input-output relationship of linear time-invariant systems using time-domain techniques and transform methods.	35	x	x	
4	Apply concepts and tools of signals and systems to solve engineering problems	10	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Students will engage in lecture activities about basic principles and theories of signals and systems, and their applications.	1, 2, 3, 4	3 hrs/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Tests (min.: 2)	1, 2, 3, 4	40	-	No
2	#Assignments (min.: 3)	1, 2, 3, 4	20	-	Yes

Continuous Assessment (%)
60

Examination (%)
40

Examination Duration (Hours)
2

Minimum Continuous Assessment Passing Requirement (%)
30

Minimum Examination Passing Requirement (%)
30

Additional Information for ATs
Remark: To pass the course, students are required to achieve at least 30% in coursework and 30% in the examination. # may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)

Assessment Task
Examination

Criterion
Achieving all CILOs

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Margin

Failure (F)
Nor even reaching Marginal

Assessment Task
Coursework

Criterion
Achieving all CILOs

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Margin

Failure (F)
Not even reaching Marginal

Part III Other Information

Keyword Syllabus

Signals
What is a signal; Basic time-domain signal operations: time shift, time reversal, time scaling; Basic continuous-time and discrete-time signals; Dirac impulse function, unit step function, complex exponentials; Energy and power signals.

Systems
What is a system; Classification of systems: linear versus nonlinear, time-invariant versus time-variant, causal versus non-casual, memoryless versus not memoryless, stable versus unstable; Representation of signals in terms of Dirac impulses; Continuous-time linear time-invariant (LTI) systems with the concepts of convolution integral; Discrete-time LTI systems with the concepts of convolution sum; Properties of LTI systems; Systems described by differential and difference equations.

Fourier Analysis for Continuous-Time Signals and Systems
Representation of periodic signals by Fourier series; Approximation of periodic signals using Fourier Series and the convergence of Fourier series; Representation of aperiodic and periodic signals by Fourier transform; Properties of the Fourier transform; Frequency response of LTI systems.

Fourier Analysis for Discrete-Time Signals and Systems
Representation of discrete-time signals by discrete-time Fourier transform; Properties of the discrete-time Fourier transform; Frequency response of discrete-time LTI systems; Sampling and reconstruction of continuous-time signals.

Laplace Transform
Definition of Laplace transform; Region of convergence for Laplace transform; Inverse Laplace transform; Geometric evaluation of the Fourier transform from the pole-zero plot; Properties of Laplace transform; Analysis and characterization of LTI systems using the Laplace transform; Partial fraction expansion; Solution of differential equations; Transfer function.

z-Transform
Definition of z-transform; Relationship with Laplace and Fourier transforms; Region of convergence for z-transforms; Properties of z-transform; Inverse z-transform; Geometric evaluation of the Fourier Transform from the pole-zero plot; Solution of difference equation; Analysis and characterization of LTI systems using z-transform.

Applications
Spectral analysis; Modulation and demodulation; Signal approximation.

Reading List

Compulsory Readings

	Title
1	A. V. Oppenheim and A. S. Willsky, Signals and Systems, 2nd Edition, Prentice Hall, 1997

Additional Readings

	Title
1	S. Haykin and B. Van Veen, Signals and Systems, 2nd Edition, Wiley, 2003