City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester A in 2020/2021

Part I Course Overview

Course Title:	Signals and Systems
Course Code:	EE3210
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	B3
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	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: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

The course aims to introduce the fundamental concepts and tools for analysis of signals and systems, so as to equip students with basic knowledge and skills required in diverse areas such as communication systems, control systems, and signal processing, and in more broad scientific and engineering disciplines.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Classify signals and systems and describe their properties on continuous and discrete domains.	10%	√	√	
2.	Describe and perform different domain transformations.	40%	√	√	
3.	Analyze the input-output relationship of linear, time-invariant systems using time-domain techniques and transform methods.	30%	√	√	
4.	Familiar with analysis and operations of linear, time-invariant systems and their application implications.	20%	√	√	
		100%			

** If weighting is assigned to CILOs, they should add up to 100%.*

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lectures	Key concepts, properties, and applications are introduced, developed, and analyzed, followed by illustrated examples.	√	√	√	√			2 hrs/wk
Tutorials	Key concepts and properties are reviewed and further demonstrated by problems of varying levels of complexity.	√	√	√	√			1 hr/wk

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: 60 %								
Tests (min.: 2)	✓	✓	✓	✓			40 %	
#Assignments (min.: 3)	✓	✓	✓	✓			20 %	
Examination: 40 % (duration: 2 hrs , if applicable)								
Examination	✓	✓	✓	✓			40 %	
** The weightings should add up to 100%.*							100%	

Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

may include homework, tutorial exercise, project/mini-project, presentation

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
Examination	Achieving all CILOs	High	Significant	Moderate	Margin	Nor even reaching Marginal
Coursework	Achieving all CILOs	High	Significant	Moderate	Margin	Not even reaching Marginal

6. Constructive Alignment with Major Outcomes

MILO	How the course contribute to the specific MILO(s)
1, 2, 3, 5, 10	The students learn methods and skills to model, analyse, and manipulate signals and systems. Examples of engineering significance are given to demonstrate how the methods and skills can help solve practical problems. The application of mathematics, science and engineering is central to the aims of this course with ample opportunity to apply these applications to the solution of engineering problems in class and in assignments.
6, 8, 9	Contemporary engineering issues and technological advances are used as benchmarks to show that the knowledge and tools in signals and systems, where used appropriately, are fundamental and prevail in past and future scientific and engineering successes.

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

Signals

What is a signal; Operating on functions to produce new functions: composition, linear combinations, series, time scale changes; 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 v. nonlinear, time-invariant v. time-varying, causal v. non-casual, memoryless v. memory, stability; Representation of signals in terms of Dirac impulses; Continuous-time 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 continuous-time Fourier Series; Approximation of Periodic Signals using Fourier Series and the convergence of Fourier series; Representation of aperiodic and periodic signals by continuous-time Fourier Transform; Properties of the continuous-time Fourier Transform; Frequency response of LTI systems.

Fourier Analysis for Discrete-Time Signals and Systems

Representation of periodic signals by discrete-time Fourier Series; Representation of aperiodic and periodic signals by discrete-time Fourier Transform; Properties of the discrete-time Fourier Transform; Frequency response of discrete-time LTI systems.

The Laplace Transform

Definition of the Laplace Transform; Region of convergence for Laplace Transforms; Inverse Laplace Transform; Geometric evaluation of the Fourier Transform from the pole-zero plot; Properties of the Laplace Transform; Analysis and characterization of LTI systems using the

Laplace Transform; Partial fraction Expansion; Solution of differential equations; Transfer function, Stability.

The z-Transform

Definition of the z-Transform; Relationship with Laplace and Fourier transforms; Region of convergence for z-Transforms; Properties of the 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; Stability; Transformation between continuous-time and discrete-time systems.

Applications

Ideal versus practical filters; High-pass and low-pass filters; Modulation and demodulation; Analysis of Electrical Networks

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Alan V. Oppenheim and Alan S. Willsky with S. Hamid Nawab: Signals and Systems, 2nd edition, Prentice Hall, 1983.

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Nil