City University of Hong Kong
Course Syllabus

offered by College/School/Department of Electrical Engineering
with effect from Semester B in2019/2020

Part I Course Overview

Course Title:	Digital Signal Processing
Course Code:	EE4015
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	B4
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)*	EE3210 Signals and Systems
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	EE4219 Digital Signal Processing
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

The aim of this course is to provide students with a good foundation and understanding of digital signal processing theories and techniques for analysis and design and to use them in different areas of applications.

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.	Identify and analyze discrete time signals and systems.		✓	✓	
2.	Process analogue signals with digital signal processing.		✓	✓	
3.	Implement FIR and IIR digital filters.		✓	✓	
4.	Design FIR and IIR filters.		✓	✓	
** If weighting is assigned to CILOs, they should add up to 100%.*		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/tutorial	Teaching activities are primarily based on lectures followed by practical examples to enable students to relate theory with practice. Concepts and ideas will be reinforced through small group discussion, in-class exercise and demonstration	✓	✓	✓	✓			3 hrs/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: 50 %								
Tests (min.: 2)	✓	✓	✓	✓			36%	
#Assignments (min.:3)	✓	✓	✓	✓			14%	
Examination: 50% (duration: 2 hrs , if applicable)								
Examination	✓	✓	✓	✓			50%	
** 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)
1. Examination	Achieving all CILOs	High	Significant	Moderate	Margin	Not even reaching marginal
2. Coursework	Achieving all CILOs	High	Significant	Moderate	Margin	Not even reaching marginal

6. Constructive Alignment with Major Outcomes

Please state how the course contribute to the specific MILO(s)

MILO	How the course contribute to the specific MILO(s)
1	An ability to apply knowledge of mathematics, science and engineering.
3	An ability to design a system, component, or process that conforms to a given specification within realistic constraints.
5	An ability to identify, evaluate, formulate and solve engineering problems.

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

1. Keyword Syllabus

Review of signals and systems

Classification of signals and systems, difference equations, impulse response, convolution, frequency response, discrete-time Fourier transform.

z-transform

Region of convergence, properties of z-transform, inverse z-transform, relation to discrete-time Fourier transform, transfer function, poles and zeros, relation to frequency response.

Digitization of analogue signals

Sampling of analogue signals, sampling theorem, aliasing and prefiltering, analogue-to-digital conversion, uniform and non-uniform quantization, analysis of quantization error, reconstruction of analogue outputs, practical considerations of ADC and DAC, digital processing of signals.

Digital filter design

Classification of digital filters, finite impulse response (FIR) and infinite impulse response (IIR) filters, realizations of FIR and IIR digital filters, direct forms, transposed structures, parallel structures, cascade structures, linear phase structures, finite word-length effects.

Properties of FIR filters, magnitude and phase responses, window design methods, frequency sampling design methods.

Properties of IIR filters, magnitude and phase responses, design of analogue filters, analogue to digital transformation, impulse invariant method, bilinear transformation, pre-warping, frequency transformation.

Discrete Fourier Transform

Discrete Fourier Series, Discrete Fourier Transform of finite duration sequences, Fast Fourier Transform, circular convolution, linear convolution and circular convolution, overlap-add and overlap-save methods, computations of convolution and correlation.

Applications of DSP in Communications

Transmultiplexing, echo cancellation, equalization, adaptive echo canceller, adaptive equalizer.

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.	Edmund M-K Lai, An Introduction to Digital Signal Processing, McGraw-Hill, 2004
2.	H.C.So, Digital Signal Processing: Foundations, Transforms and Filters, with Hands-on MATLAB Illustrations, McGraw Hill, 2011

2.2 Additional Readings

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

1.	Mitra, Sanjit K., Digital Signal Processing: A Computer-Based Approach, Third Edition, McGraw-Hill, 2006
2.	Proakis J G and Manolakis D G, Digital Signal Processing: Principles, Algorithms, and Applications, Fourth edition, Prentice Hall, 2007.
3.	Oppenheim, A. V., Schafer, R. W., and Buck, J. R., Discrete-time Signal Processing, Second Edition, Prentice Hall, 1999.