SYLLABUS

1. **Course name:** Digital Signal Processing (DSP)
2. **Course code:** DSPR431264E
3. **Credits:** 3 (3/0/6)

   Duration: 15 weeks (45 hours for in-class and 90 hours for self-study)
4. **Instructors**
   1. Lê Minh Thành, MEng.
   2. Đặng Phước Hải Trang, MEng.
   3. Huỳnh Thị Thu Hiền, MEng.
5. **Course conditions**

   Prerequisites: Signals and Systems

   Corequisites: N/A
6. **Course description**

   This course provides students the knowledge related to the sampling and reconstruction of signals; time domain analysis of DT signals and systems; Z-transformation; frequency domain analysis of DT signals and systems such as DTFS, DTFT, N-DFT, and FFT. In addition, applications of digital signal processing are also discussed.
7. **Course goals**

Goals	Goal description *This course provides students:*	ELOs
G1	Basic knowledge of the theory and analytical methods of signals and systems in digital signal processing.	01 (H)
G2	An ability of explanation and analysis of the signal processing techniques.	02 (H)
G3	An ability of team working, communication, and comprehension of the technical documents in English.	03 (M)
G4	An ability of design of the desired digital signal processing systems.	07(M)
G5	An ability of programming and simulating the DT signals and systems, digital filter systems.	11(L)

** Notes: H: **H**igh; M: **M**edium; L: **L**ow*

8. **Course learning outcomes (CLOs)**

CLOs		Description *After completing this course, students can:*	ELOs
G1	**G1.1**	Represent the sampled and reconstructed signals in the time domain and frequency domain.	01
	G1.2	Describe and analyze the time and frequency properties of DT signals and systems.	01
	G1.3	Determine and represent the impulse responses of the DT systems.	01

G2	**G2.1**	Use the DTFS to represent the periodic DT signals.	01, 02
	G2.2	Apply the DTFT to analyze the DT signals.	01, 02
	G2.3	Use N-point DFT to analyze the non-periodic DT signals.	02
	G2.4	Present the properties of FFT.	02
	G2.5	Present the properties of Z transformation.	02
G3	**G3.1**	Find the related documents, self-study, and present the professional contents.	03
	G3.2	Cooperate in team-working, discuss, and solve problems related to signal processing.	03
	G3.3	Comprehend professional terms in English.	03
G4	**G4.1**	Plot the zero-pole plane and apply Z transformation for the DT systems.	02, 07
	G4.2	Design FIR/IIR filters.	07
	G4.3	Design and evaluate the performance of DT systems in time and frequency domain.	07
G5	**G5.1**	Use software such as C and Matlab to analyze the DT signals and systems.	11

9. Study materials

a. Textbooks:

[1] Nguyễn Hữu Phương, *Xử lý tín hiệu số*, Nhà xuất bản Thống Kê, 2003.

b. References:

[2] Lê Tiến Thường, *Xử lý số tín hiệu*, NXB ĐHQG, 2005.

[3] Nguyễn Quốc Trung, *Xử lý tín hiệu và lọc số*, NXB KH–KT, 2001.

[4] J.G. Proakis – D.G. Manolakis, *Digital Signal Processing*, 4th edition, Prentice Hall, 2007, ISBN-10: 0131873741.

[5] SJ. Orfanidis, *Introduction to Signal Processing*, Rutgers University, author edition at *http://www.ece.rutgers.edu/~orfanidi/intro2sp*.

10. Student assessments

a. Grading points: 10

b. Plan for student assessments is followed:

Types	Contents	Time-lines	Assessment techniques	CLOs	Rates (%)
Formative assessments					**50**
M	Covering the contents from chapter 1 to chapter 3.	Week 8	Paper-based individual assessment in class	G1.1, G1.2, G1.3, G2.5, G4.1	20
M	Covering the contents from chapter 3 to chapter 5.	Week 13	Paper-based individual assessment in class	G2.1, G2.2, G2.3, G4.3	20
Q/H	Covering the contents from chapter 1 to chapter 6.	Week 1-15	In-class problems, and/or homework, and/or exercises on LMS	G3.1, G3.2, G3.3, G5.1	10
Summative assessments					**50**

F	Covering all contents related to the expected learning outcomes of the course.		Paper-based individual assessment as listed by AAO		50

** Notes: Q: **Q**uiz; H: **H**omework; P: **P**roject; M: **M**idterm Exam; F: **F**inal Exam;*

11. Course details:

Weeks	Contents	CLOs
1	***Chapter 1.*** **Sampling and reconstruction of CT signals** *(3/0/6)*	
	Contents: *(3)* 1.1 Sampling and sampling theorem. 1.2 Aliasing. 1.3 Anti-aliasing filter. **Teaching methods**: + Slide presentation + Questions	G1.1; G3.1
	Self-study contents: *(6)* Problems in chapter 3 of the textbook.	
2	***Chapter 1.*** **Sampling and reconstruction of CT signals (cont'd)** *(3/0/6)*	
	Contents: *(3)* 1.4 Oversampling. 1.5 Reconstruction of signals. **Teaching methods**: + Slide presentation + Questions and answers	G1.1, G3.1
	Self-study contents: *(6)* Problems in chapter 3 of the textbook.	
3	***Chapter 2.*** **DT signals and systems** *(3/0/6)*	
	Contents: *(3)* 2.1 DT signals. 2.2 Energy and power of DT signals. 2.3 DT systems. **Teaching methods**: + Slide presentation + Questions	G1.2; G5.1; G3.2; G3.3
	Self-study contents: *(6)* Group students and assign topics as student groups	
4	***Chương 2.*** **DT signals and systems (cont'd)** *(3/0/6)*	
	Contents: *(3)* 2.4 Types of DT systems. 2.5 Impulse response and step response. **Teaching methods**: + Slide presentation	G1.2; G1.3

	+ Questions	
	Self-study contents: *(6)* Problems in chapter 4, 5 of the textbook.	
5	***Chapter 2.*** **DT signals and systems (cont'd)** *(3/0/6)*	
	Contents: *(3)* 2.6 Difference equation of LTI systems. **Teaching methods**: + Slide presentation + Questions and answers	G1.2; G1.3
	Self-study contents: *(6)* Problems in chapter 4, 5 of the textbook.	
6	***Chapter 3.*** **Z transformation** *(3/0/6)*	
	Contents: *(3)* 3.1 Z transformation. 3.2 Region of convergence (ROC). 3.3 Zero-pole plot. **Teaching methods**: + Slide presentation + Questions	G2.5; G4.1
	Self-study contents: *(6)* Problems in chapter 8 of the textbook.	
7	***Chapter 3.*** **Z transformation (cont'd)** *(3/0/6)*	
	Contents: *(3)* 3.4 Z inverse transform. 3.5 Transfer function. **Teaching methods**: + Slide presentation + Questions and answers	G2.5; G4.1; G4.3
	Self-study contents: *(6)* Problems in chapter 8 of the textbook.	
8	**Revision and formative test 1**	
9	***Chapter 4.*** **Analysis of DT signals and systems in frequency domain** *(3/0/6)*	
	Contents: *(3)* 4.1 DTFS. 4.2 DTFT. **Teaching methods**: + Slide presentation + Discussion	G2.1; G2.2
	Self-study contents: *(6)* Problems in chapter 6 of the textbook.	
10	***Chapter 4.*** **Analysis of DT signals and systems in frequency domain (cont'd)**	

	(3/0/6)	
	Contents: *(3)* 4.3 Frequency response of LTI systems. **Teaching methods**: + Slide presentation + Discuss in groups	G2.1; G2.2; G4.3
	Self-study contents: *(6)* Problems in chapter 6 of the textbook.	
11	***Chapter 5.*** **Discrete Fourier transform and fast Fourier transform** *(3/0/6)*	
	Contents: *(3)* 5.1 Discrete Fourier transform (DFT). **Teaching methods**: + Slide presentation + Questions	G2.3
	Self-study contents: *(6)* - Applications of DFT transform. - Problems in chapter 11 of the textbook.	
12	***Chương 5.*** **Discrete Fourier transform and fast Fourier transform (cont'd)** *(3/0/6)*	
	Contents: *(3)* 5.2 Fast Fourier transform (FFT). **Teaching methods**: + Slide presentation + Questions and answers	G2.4
	Self-study contents: *(6)* - Applications of FFT. - Problems in chapter 11 of the textbook.	
13	**Revision and formative test 2**	
14	***Chapter 6.*** **Design the non-recursive FIR filter** *(3/0/6)*	
	Contents: *(3)* 6.1 Non-recursive filter and FIR filter. **Teaching methods**: + Slide presentation + Questions	G4.2; G4.3
	Self-study contents: *(6)* Problems in chapter 10 of the textbook.	
15	***Chapter 6.*** **Design the non-rescursive FIR filter (cont'd)** *(3/0/6)*	
	Contents: *(3)* 6.2 Design using the inverse Fourier transformation. 6.3 Design using the window methods. 6.4 Revision	G4.2; G4.3

	Teaching methods: + Slide presentation + Questions and answers	
	Self-study contents: *(6)* Problems in chapter 10 of the textbook.	

12. Learning ethics:

Homework assignments and projects must be done by the students themselves. Plagiarism found in the assessments will get point of zero.

13. First approved date: 15 / 01 / 2012

14. Approval level:

Dean	**Department**	**Instructor**
Nguyễn Minh Tâm, PhD.	**Nguyễn Ngô Lâm, MEng.**	**Lê Minh Thành, MEng.**

15. Syllabus updated process

1st updated content date: 15/01/2014	**Instructor**: Lê Minh Thành, MEng. **Head of dept.**: Võ Minh Huân, PhD.
2nd updated content date: 15/01/2016	**Instructor**: Lê Minh Thành, MEng. **Head of dept.**: Phan Văn Ca, PhD.