Co-funded by the Erasmus+ Programme of the European Union

SMARTCITY
Innovative Approach Towards a Master Program on Smart Cities Technologies

Mongolian University of Science and Technology
Curriculum development and Registration office

COURSE SYLLABUS			
Course Title	Digital Signal Processing		
Course code	F.EE703	**No. of Credits**	3
Department	Communication	**School**	SICT of MUST
Pre-requisites Course Code	None	**Co-requisites Course code**	None
Course coordinator	Erdenebayar.L	**Room number**	212
Email	erdenebayar.l@must.edu.mn	**Telephone No.**	91008480
Other Instructor(s)	None		
Learning Hours	Total: 144 Learning hours (2:2:0:5) Lecture(32 hr), Seminar(16 hr), Laboratory(16 hr), Assessment(80 hr)		
Course type	☑ Compulsory ☐Elective ☐ Selected elective ☐ Other		
Offer in Academic Year	☑ 1st Semester ☑ 2nd Semester ☐ Summer ☐ Year Long		
Introduction language	Mongolian or English		

AIMS AND OBJECTIVES:

- The course aims to introduce concepts and methods of DSP.
- It describe's discrete signals and systems and their applications.
- Generate various discrete time signal sequences and perform simple operations to process signal sequence
- The course covers discrete-time convolution, difference equations, the z-transform and the discrete Fourier transform.
- Designing of both recursive and non-recursive digital filters.
- The use of MATLAB and Simulink for examples and reinforcement of comprehension is essential part of the course.

ESSENTIAL READINGS: (Journals, textbooks, website addresses etc.)

BIBLIOGRAPHY:

- Oppenheim, Alan V. and Schafer, Ronald W. and Buck, John R., Discrete-Time Signal Processing, 2nd edition, Prentice-Hall, 1999, ISBN: 978-0-137-54920-7.
- Proakis, John G. and Manolakis, Dimitris G., Digital Signal Processing, 4th edition, Prentice-Hall International, 2006, ISBN: 978-0-131-87374-2.
- Hayes, Monson H. Digital signal processing Tata McGraw-Hill edition 2004

COURSE DESCRIPTION

This course provides an introduction to processing of discrete-time (DT) signals. Fundamental principles of DT systems and signals, in both time and Fourier domains, are presented. These are followed by modern applications of digital signal processing (e.g telecommunications). Throughout the course, the focus is on developing techniques and algorithms for solving discrete-time signal processing problems.

TEACHING METHODS: Flipped classroom and problem-based learning (Blended learning)

COURSE CONTENT

Course topics for lecture:	**Lecture hours**
• Introduction to the z-Transform	2
• Inverse z-Transform; Poles and Zeros	2
• Radix-2 Fast Fourier Transforms	2
• The Cooley-Tukey and Good-Thomas FFTs	2
• Continuous-time filtering with digital systems; upsampling and downsampling	2
• Multirate signal processing and polyphase representations	2
• FIR filter design using least-squares	2
• FIR filter design (Chebyshev)	2
• IIR filter design	2
• Introduction to adaptive filtering; ARMA processes	2
• The Wiener filter	2
• Gradient descent and LMS	2
• Least squares and recursive least squares	2
• Introduction to quantization	2
• Differential quantization and vocoding	2
• Perfect reconstruction filter banks and intro to wavelets	2
Course topics for seminar:	**Seminar hours**
• Signals and Linear, time-invariant systems	2
• Convolution and its properties	2
• The Fourier Series	2
• The Fourier Transform	2
• Frequency Response	2
• The Discrete-Time Fourier Transform	2
• The Discrete Fourier Transform	2
• The Sampling Theorem	2
Course topics for laboratory:	**Laboratory hours**
• Matlab for DSP; introduction to Coursework	2
• z-Transform	2
• Fast Fourier Transforms	2
• FIR filter design	2
• IIR filter design	2
• Adaptive filtering	2
• The Wiener filter	2
• Differential quantization	2

COURSE LEARNING OUTCOMES (CLOs)		Aligned PLOs
By the end of the main course, the students should be able to:		
1.	To describe the characteristics and transformations of discrete time signals mathematically;	
2.	Apply techniques in time and transform domains to the analysis and design of discrete-time systems;	
3.	Learns basic digital filter design methods: (i) Learns analog Butterworth and Chebyshev filters transformed to yield digital IIR filters, (ii) impulse-invariance and bilinear transformation methods for IIR filter design and (iii) FIR filter design methods based on windowing.	
4.	Be able to explain and evaluate advanced technical concepts concisely and accurately	
5.	Be able to select, adapt and apply a range of mathematical techniques to solve advanced problems	
By the end of the laboratory, the student should be able to:		
6.	To design of FIR/IIR filters, draw frequency response of filters using MATLAB	
7.	To write object oriented DSP filter code in MATLAB which can be used in production	
8.	Identify the team work	

COURSE TEACHING AND LEARNING ACTIVITIES

Weekly contact hours: (2:1:1:5)-1×2 hours lecture, 2×2 hours seminar, 2×2 hours laboratory. Traditional and active learning methods will be used within lecture, seminar, laboratory and homework assignments

Learning methods /Pedagogy/	Types of teaching method	CLOs
➢ Problem based	✓ Lecture, Seminar	1,2,3,4,5
➢ Inquire based	✓ Laboratory	6,7,8

COURSE ASSESSMENT METHODS

Assessment tools	Assessment frequency	Weight	Aligned CLOs
Attendance/participation in class	Weekly	8%	1,2,3,4
Homework/assignment	Every 3 weeks	15%	2,3,6
Midterm exam	8, 13th week	15%	1,2,3,4
Laboratory	Every 2 weeks	32%	6,7,8
Final exam	17th week	30%	1,2,3,4

REVISED BY:			
Course coordinator	**L.Erdenebayar**	**Date:**	**25/08/2020**
APPROVED BY:			
Head of Department		**Date:**	