FACULTAD DE CIENCIAS E INGENIERÍA

DIGITAL SIGNAL PROCESSING
2020-1

I. INFORMACIÓN GENERAL

CURSO	DIGITAL SIGNAL PROCESSING
CLAVE	1ING09
CRÉDITOS	3
HORAS DE DICTADO	CLASE: 2 Semanal LABORATORIO: 2 Semanal EXAMEN:
HORARIO	TODOS
PROFESORES	STEFANO ENRIQUE ROMERO GUTIERREZ

II. PLANES CURRICULARES DONDE SE DICTA EL CURSO

ESPECIALIDAD	ETAPA	NIVEL	CARÁCTER	REQUISITOS
INGENIERÍA BIOMÉDICA	PREGRADO EN FACULTAD	7	OBLIGATORIO	MAT202 SERIES Y TRANSFORMADAS [07]

Tipos de requisito

04 = Haber cursado o cursar simultaneamente
05 = Haber aprobado o cursar simultaneamente
06 = Promedio de notas no menor de 08
07 = Haber aprobado el curso

III. DESCRIPCIÓN DEL CURSO

This course introduces the basic concepts to analyze discrete-time signals and systems. The student will develop the necessary skills to apply theoretical concepts in the activities that involve digital signal processing. The laboratory sessions will be focused to evaluate the application of the theoretical background as well as a high level programming skills in simulation environments.

IV. SUMILLA

This course covers the fundamental concepts of digital signal processing. The students will learn about sampling theorem, discrete convolution and correlation of signals, linear systems, time-frequency analysis, discrete Z transform, and discrete Fourier transform. In addition, the course covers the use of digital filters and adaptives filter to enhance the input signal. An introduction of digital image processing in the spatial domain will also be in the scope of the course.

V. OBJETIVOS

At the end of this course, the students will be able to:

- Analyze signals using mathematical algorithms.
- Perform a spectral analysis of various types of signals.
- Apply digital filters to signals.
- Understand basic image processing techniques

VI. PROGRAMA ANALÍTICO

CAPÍTULO 1 DISCRETE-TIME SIGNALS AND SYSTEMS (3 horas)

1.1 Frequency on discrete time
1.2 Analog signal sampling
1.3 Nyquist Theorem
1.4 Discrete time signal properties
1.5 Discrete time system properties
1.6 Linear time-invariant systems

CAPÍTULO 2 LTI SYSTEMS AND Z TRANSFORM (3 horas)

2.1 Impulse response
2.2 LTI system implementation
2.3 Correlation of discrete-time signals
2.4 Definition of the z-transform
2.5 Convergence
2.6 Inverse Z-transfrom
2.7 Analysis of LTI through Z transform

CAPÍTULO 3 FREQUENCY ANALISIS OF SIGNALS AND SYSTEMS (4 horas)

3.1 Introduction to spectrum frequency
3.2 Basic relations between time domain and frequency domain
3.3 Sampling and reconstruction analog signal
3.4 Sample rate: upsampling, downsampling, interpolation, decimation
3.5 Analysis of frequency discrete-time system

CAPÍTULO 4 DISCRETE FOURIER TRANSFORM (4 horas)

4.1 Sampling frequency of Discrete Fourier Transform
4.2 Relation between Fourier Transfrom and Z-Transform
4.3 Circular convolution
4.4 Properties of Discrete Fourier Transform
4.5 Efficient algorithm for Discrete Fourier Transform calculation

CAPÍTULO 5 DIGITAL FILTER DESIGN (4 horas)

5.1 Finite Impulse Response: Windowing method and Sampling Frequency
5.2 Infinite Impulse Response: Impulse Invariant and Bilinear transfromation
5.3 Analog filter design: Butterworth and Chebyshev
5.4 Optimal Filter
5.5 Adaptive Filter

CAPÍTULO 6 INTRODUCTION TO DIGITAL IMAGE PROCESSING (2 horas)

6.1 Image acquisition
6.2 Sampling and quantized images.
6.3 Basic relation between pixels

CAPÍTULO 7 IMAGE ENHACEMENT IN SPATIAL DOMAIN (3 horas)

7.1 Intensity transformation
7.2 Histogram equalization
7.3 Morphological operations
7.4 Bidimensional Convolution

CAPÍTULO 8 IMAGE ENHACEMENT IN FREQUENCY DOMAIN (3 horas)

8.1 Bidimensional Fourier Transform
8.2 Bidimensional Fourier Transform Properties
8.3 Image smoothing
8.4 Image sharpening

VII. METODOLOGÍA

This course will have a theoretical classes as well as practical laboratories sessions to provide representative applications on digital signal processing applications.

VIII. EVALUACIÓN

Sistema de evaluación

N°	Codigo	Tipo de Evaluación	Cant. Eval.	Forma de aplicar los pesos	Pesos	Cant. Eval. Eliminables	Consideraciones adicionales	Observaciones
1	Pb	Práctica tipo B	10	Por Promedio	Pb=4	0		
2	Ex	Examen	2	Por Evaluación	Ex1=3 Ex2=3			
3	Em	Ev. Remedial PUCP-UPCH	1	Por Evaluación	Em1=0			

Fórmula para el cálculo de la nota final

(4Pb + 3Ex1 + 3Ex2) / 10

Ev. Remedial PUCP-UPCH se aplica sólo para alumnos del convenio PUCP-UPCH de la siguiente forma:

- Si el alumno desaprueba el promedio final del curso con una nota mayor o igual a 08.
- El promedio del curso será 11 si el alumno aprueba el examen remedial.
- El promedio del curso no se modifica si el alumno desaprueba el examen remedial.

Aproximación de los promedios parciales No definido

Aproximación de la nota final No definido

Consideraciones adicionales

Modalidad de evaluación 2.
Fórmula para el cálculo de la nota final
(4Pb+3Ex1+3Ex2) / 10

IX. BIBLIOGRAFÍA

Referencia obligatoria

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X. POLÍTICA CONTRA EL PLAGIO

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