DIGITAL SIGNAL PROCESSING

Code	Credit Hours
EE-330	3-1

COURSE DESCRIPTION:

The purpose of this course is to develop physical and mathematical significance of Digital Signal Processing from theoretical, application and implementation perspectives. The topics include a quick review of Discrete-Time signals and systems, z-transform, Discrete-Time Fourier transform (DTFT) and bandlimited sampling. An introduction to multirate systems will then be covered with some applications. Discrete Fourier Transform (DFT) is then introduced as a practical spectral analysis tool followed by algorithms for efficient computation of DFT (such as Fast Fourier Transform (FFT) and Goertzel Algorithm). A good portion of the course focuses on the frequency domain analysis of systems and the structures for system implementation. Different techniques for filter design against given specifications are then introduced with their practical significance.

TEXTBOOK:

Discrete Time Signal Processing, A. V. Oppenheim and R. W. Schaffer, 3rd Edition, 2010

REFERENCE BOOK:

1. Understanding Digital Signal Processing, R. G. Lyons, 3rd Edition, 2011.
2. Digital Signal Processing: Principles, Algorithms and Applications, J. G. Proakis and D. G. Manolakis, 4th Edition, 2007.
3. Signal Processing First, McClellan, Shafer and Yoder, 2nd Edition, 2008.

PREREQUISITES

EE 232 (Signals & Systems)

ASSESSMENT SYSTEM FOR THEORY

Quizzes	5-10%
Assignments	5-10%
Mid Terms	25-35%
ESE	40-50%

ASSESSMENT SYSTEM FOR LAB

Quizzes	10%-15%
Assignments	5% - 10%
Lab Work and Report	70-80%
Lab ESE/Viva	20-30%

TEACHING PLAN

WEEK NO	TOPICS	LEARNING OUTCOMES
1	Introduction	Course Outline, objectives, teaching plan, assessment method, concepts review
2-5	Basic Signal Processing	Review of LTI Systems, Eigen Function Property, z-Transform, and sampling of bandlimited signals, Sampling Rate Conversion, Reconstruction of a band limited signal from its samples, Discrete time processing of continuous time signals
6-8	Transform Analysis of LTI Systems	Transform Analysis of LTI Systems, Frequency response of LTI Systems, Minimum Phase System, All Pass Systems, Block Diagram Representation of Linear, Generalized Linear Phase Systems
9	**MID TERM EXAM**	
10-12	Filter Designing & Structures	Analog Filter Design Basics Design of FIR Filters using Windowing Method, Design of IIR Filters, Design Comparison of Digital Filters, Structures for Discrete Time Systems
13-15	Discrete Fourier Transform & Z-Transform	DFS, DFT, Spectral Leakage, Sampling of DTFT/ Discrete Fourier Transform, Block Convolution, Circular Convolution, Computational Complexity of DFT and FFT implementation, Z-Transform and its Properties
16-17	Adaptive Filtering & Wavelet Transforms	LMS Algorithm, NLMS Algorithm, RLS Algorithm, Continuous Wavelet Transform, Discrete Wavelet Transform, Wavelet Packet Transform
18	**END SEMESTER EXAMS**	

Lab Experiments:

NO	DESCRIPTION
1	MATLAB Review-Signals and Systems Fundamentals
2	Complex Exponentials and Sinusoids
3	Digital Images: A/D and D/A
4	Sampling and Quantization of audio signal in Matlab
5	Frequency Response and Pole Zero Plots of Filters
6	Frequency Response, Bandpass and Nulling Filters
7	Introduction to DSP KIT TMS 320C6713 DSK
8	Audio Processing using TMS 320C6713 DSK
9	Sampling, Quantization, Aliasing using DSK
10	Delays and FIR Filtering (DSK)
11	FIR Filter Design Using Windowing
12	IIR Filter Design using Analog Design Techniques-Open Ended Lab
13	DFT and Spectrum Leakage
14	DFT Properties and Block Convolution
15	Semester Project