DIGITAL SIGNAL PROCESSING

Course Code: 13EC1122

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Pre requisites: Signals and Systems

Course Educational Objectives:

- To have an overview of signals and systems.
- To study DFS, DTFT, DFT & FFT.
- To understand the design techniques for digital IIR and FIR filters.
- To study Multirate DSP & the applications of DSP.

Course Outcomes:

At the end of this course, the student should be able to know

- How to represent discrete time signals and systems.
- The basic principles of digital signal processing.
- Frequency response and design of FIR and IIR filters.
- The concept of Multirate DSP and applications of DSP.

UNIT-I (12 Lectures)

INTRODUCTION:

Introduction to Digital Signal Processing, Reviewof discrete-time signals and systems, analysis of discrete-time linear time invariant systems, Frequency domain representation of discrete time signals and systems.

DISCRETE CONVOLUTION:

Introduction, Impulse Response and Convolution Sum, Convolution of Infinite sequences, Circular shift and Circular Symmetry, Periodic and Circular Convolution, Methods of obtaining Circular Convolution.

UNIT-II (12 Lectures)

DISCRETE FOURIER SERIES AND DISCRETE TIME FOURIER TRANSFORM:

Introduction, Discrete Fourier Series, Properties of DFS, Introduction to

Discrete time Fourier transform, Inverse DTFT, Properties of DTFT, Relation between Z-Transform and DTFT, Frequency Response of Discrete Time Systems, Transfer Functions.

UNIT-III (14 Lectures)

DISCRETE FOURIER TRANSFORM:

Introduction, Discrete Fourier Transform, Inverse DFT, Properties of DFT, Linear Convolution and Circular Convolution using DFT.

FAST FOURIER TRANSFORM:

Introduction, Fast Fourier Transform, Radix-2 Decimation in time FFT, Radix-2 Decimation in frequency FFT, Inverse FFT.

UNIT-IV (15 Lectures)

DESIGN OF DIGITAL FILTERS:

IIR FILTERS: Introduction, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters.

FIR FILTERS: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using windows (Rectangular, Triangular, Raised Cosine, Hanning, Hamming, Blackman and Kaiser), Comparison of IIR & FIR filters,Basic structures of FIR Filters.

UNIT-V (12 Lectures)

MULTIRATE DIGITAL SIGNAL PROCESSING:

Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion.

APPLICATIONS OF DSP: Voice Synthesizers, Vocoders, Image Processing (Qualitative Treatment Only), Radar Signal Processing.

TEXT BOOKS:

1. John G.Proakis, Dimitris G.Manolakis, *"Digital Signal Processing, Principles, Algorithms and Applications"*, Pearson Education / PHI, 4th Edition, 2013.

2. A.V.Oppenheim and R.W.Schaffer, *"Discrete – Time Signal Processing"*, PHI, 4th Edition, 2007

REFERENCES:

1. S.K.Mitra, *"Digital Signal Processing – A practical approach"*, Pearson Education, New Delhi, 2003.
2. M.H.Hayes, *"Digital signal processing: Schaum's Outlines"*, Tata Mc-Graw Hill, 2nd Edition, 2009
3. Robert J.Schilling, Sandra L.Harris, *"Fundamentals of Digital Signal Processing using Matlab"*, Thomson, 2007.
4. Ramesh Babu, *"Digital Signal Processing"*, SCITECH Publications, 4th Edition, 2009.
5. A.Anandkumar, *"Digital Signal Processing"*, PHI, Eastern Economy Edition, 2013.