III B.Tech II Semester

15AEC33 - DIGITAL SIGNAL PROCESSING

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Course Objectives:

1. *To use Z transforms and discrete time Fourier transforms to analyze a digital system.*
2. *To design and analyze simple finite impulse response filters*
3. *To understand stability of FIR filters*
4. *To know various structures used in the implementation of FIR and IIR filters*
5. *Window method design structure for implementation.*

UNIT-I

Introduction: Review of discrete-time signals and systems–Time domain analysis of discrete-time signals & systems, Frequency domain analysis of discrete-time signals and systems.

Discrete Fourier Transform: Frequency-domain sampling and reconstruction of discrete-time signals, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

UNIT-II

Fast Fourier Transform Algorithms (FFTA): Fast Fourier transforms (FFT)-Radix2 decimation in time and decimation in frequency FFT algorithms, inverse FFT and FFT for composite N, Applications of FFT algorithms – Efficient computation of the DFT of two real sequences, 2N point real sequences, Use of the FFT algorithm in linear filtering and correlation, Quantization errors in the computation of DFT.

UNIT-III

Implementation of Discrete-Time Systems: Overview of Z-transform, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice –Ladder structure. Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures

UNIT-IV

Design of Digital Filters: General considerations–Causality and its implications, Characteristics of practical Frequency Selective Filters,

Design of IIR filters from analog filters–IIR filter design: approximation of derivatives, Impulse invariance method and bilinear transformation method, Frequency transformation in the analog and digital domains, Illustrative problems.

Design of FIR filters–Symmetric and asymmetric FIR filters, Design of linear phase FIR filters: using windows, using frequency sampling method.

UNIT-V

Multirate Digital Signal Processing: Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

***Course Outcomes**: At the end of the course, the student should be able to*

- *a Understand of various signals and systems using Discrete Fourier Transform (DFT).*
- *b Explain various algorithms using Fast Fourier Transforms (FFT).*
- *c Implement IIR and FIR Digital Filter Structures using different methods.*
- *d Design IIR and FIR digital filter using various methods*
- *e Understand Multirate Digital Signal Processing with Interpolation and Decimation methods.*
- *f Explain various applications of Multirate Signal Processing*

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," 4th Edition, Pearson Education, 2007.
2. P.RameshBabu, Digital Signal Processing, 4th Edition, SciTech Publishing, 2012.

REFERENCES:

1. Sanjit K Mitra, "Digital Signal Processing, A computer base approach," 3rd Edition, Tata McGraw Hill, 2009.
2. A. Anand Kumar, "Digital Signal Processing," 2nd Edition, PHI Learning, 2011