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| **EC6501** | **Digital Signal Processing** | **L-T-P: 3-1-0; Total 42 lectures** |

***Prerequisites:* (i)** Signals and System Analysis

***Objectives:*** This course concerns with different concepts of Digital Signal Processing and it's need for different real world applications.

***Course Detail :***

**UNIT –I: Review of z-transform and DTFT-**Review of z-transform and DTFT.

**UNIT –II: Discrete Fourier Transform (DFT)-**Frequency domain sampling (Sampling of DTFT), DFT and its inverse, zero padding, DFT as a linear transformation (matrix method), properties. Spectrum analysis using DFT. Filtering of long data sequences using DFT: overlap save method, overlap add method.

**UNIT –III: Fast Fourier Transform (FFT): Radix-2 FFT algorithms-**Decimation-in-time (DIT-FFT) algorithm, Decimation-in-frequency (DIF-FFT) algorithm. Inverse DFT using FFT algorithms.Goertzel algorithm, Chirp-z transform algorithm.

**UNIT –IV: Filter Concepts-**Frequency response and filter characteristics, phase delay and group delay, zero-phase filter, linear-phase filter, Simple FIR filters, Simple IIR filters, All pass filter, Minimum-phase system, Averaging filter, Comb filter, Digital resonator, Notch filter, Digital sinusoidal oscillator.

**UNIT –V: FIR Digital Filter-**Desirability of linear-phase filters, Frequency response of linear phase FIR filters, Filter specifications: absolute specifications, relative specifications, analog filter specifications. Design techniques: windowing, frequency sampling method, digital Hilbert transformer.

**UNIT –VI : IIR Digital Filter-**Analog filters, Butterworth and Chebyshev approximation. Elliptic Filter, Bessel Filter. Bilinear transformation method, warping effect. Spectral transformation. Design of low pass , high pass, band pass and band elimination filter

**UNIT –VII: Realizations of Digital Filters-**FIR filter structures: direct form, cascade form, linear-phase form, FIR Lattice structure. IIR filter structures: direct form-I, direct form-II, cascade form, parallel form, All pole lattice structure, lattice-ladder (pole-zero) lattice structure.

**UNIT –VIII: Multi-rate Signal Processing-**Decimation, Interpolation, The polyphase decomposition, Digital filter banks, Nyquist filters, Two-channel QMF.

***Text Book:***

1. Digital Signal Processing by Alan V. Oppenheim, Ronald W. Schafer , PHI

***Reference Book****:*

1. S K Mitra, Digital Signal Processing-A Computer Based Approach, Tata McGraw Hill.
2. Digital Signal Processing by John G. Proakis, Dimitris K Manolakis, Pearson.

***Course Outcom****e:* Upon successful completion of this course, students should be able to understand the following:

1. Representation of discrete time signals in temporal and spectral domain.
2. Processing of the Discrete-time signals in temporal and spectral domain.
3. Analysis and design of different Infinite Impulse Response (IIR) filters and Finite Impulse Response (IIR) filters.
4. Realization of digital filters.
5. The concepts of Multi-rate digital signal processing and it's need for signal processing task.
6. The applications of digital signals processing for different real world applications.