PEI102: DIGITAL SIGNAL PROCESSING TECHNIQUES

L	T	P	Cr
3	1	2	4.5

Course objective: To understand the concepts, classifications and properties of discrete time signals and systems, to understand frequency domain analysis, awareness about filter designing and structure.

Discrete Time Signals and Systems: Introduction, Discrete time signals as array of values, Standard discrete time signals, Classification of discrete time signals, Discrete time systems and their classifications, Linear Time Invariant (LTI) Systems, Difference Equations: Finite Impulse Response (FIR) systems, Infinite Impulse Response (IIR) systems, Non-recursive Systems and Recursive Systems and representation of discrete time systems via difference equations, Correlation: Cross-correlation and Auto-correlation and their properties, Analog to Digital (A/D) Conversion: Sampling, Frequency Relationships, Aliasing, Quantization, Encoding, Sampling Theorem and Anti Aliasing Filter.

The z-Transforms: Introduction, z-transform, Properties of z-transform, Inverse z-transform, System function and Pole-zero plots from z-transform, Causality and Stability in terms of z-transform, Bilateral z-transform, Computation of z-transform

Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Discrete Fourier Transform and its Properties, Efficient Computation of DFT using FFT algorithms: Direct computation of the DFT, Divide and Conquer Approach, Radix-2 and Radix-4 FFT algorithms, Linear Filtering Approach to Computation of DFT.

Digital Filter Structure: Describing Equation of digital filter, Structures for FIR Systems: Direct Form Structure, Cascade Form Structure, Frequency Sampling Structure and Lattice Structure, Structure for IIR Systems: Direct Form Structures (Form-I and Form-II), Cascade Form Structure, Parallel Form Structure and Lattice Structure, Representation of Structures using Signal Flow Graph.

Design of Digital Filters: Characteristics of Practical Frequency Selective Filters, Design of FIR Filters using Windows: Rectangular, Bartlett, Hanning, Hamming and Blackman, Design of IIR Filters from Analog Filters, Frequency Transformations.

Multirate Digital Signal Processing: Introduction, Decimation by factor D, multistage implementation of sampling rate conversion, sampling rate conversion of bandpass filters.

Optimum Filters: Introduction, Forward and backward predictions, AR lattice and ARMA lattice ladder filters, Wiener filters for filtering and prediction.

Laboratory work: Calculation of Z transform, Calculation of Fourier transform, Design of FIR and IIR filters, Multirate signal processing, Design of optimum filters, realization of prediction.

Course learning outcome (CLO): After the completion of the course the students will be able to:

1. Identify various type of discrete signal and systems.
2. Analyse frequency domain response of systems.
3. Design various type of filter.

4. Implement filter structures.

Recommended Books:

1. *Proakis, J.G. and Manolakis, D.K., Digital Signal Processing, Prentice Hall of India (2006 4th ed).*
2. *Rabiner, Lawrence R. and Gold, B., Theory and Applications of Digital Signal Processing, Prentice Hall of India (2000).*

Evaluation Scheme:

Evaluation Elements	Weightage (%)
MST	25
EST	35
Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	40