EOPC3002 DIGITAL SIGNAL PROCESSING (3-0-0)

Course Objectives:
This course introduces fundamental concepts of digital signal processing, covering signal representation, z-transforms, and discrete-time systems. Students will analyze LTI systems using DFT/FFT, design FIR/IIR filters (window method, bilinear transformation), and implement adaptive filters. Emphasis is placed on practical applications, including spectral estimation and digital filter realization.

Module-I: (06 hours)
Signals: Representation of signals on orthogonal basis, sampling and reconstruction of signals, Discrete time signals/sequences, Discrete time systems. Analysis and response (convolution sum) of discrete - time linear LTI system, Correlation of discrete time Signal.
The z-transform, Analysis of LTI systems using z-transform, Properties of z-transform.

Module-II: (06 hours)
Inverse Z-Transform, Inversion Z-Transform by Power Series Expansion, Inversion of the Z-Transform by Partial-Fraction Expansion, Analysis of Linear Time-Invariant Systems in the z-Domain.
Frequency analysis of LTI systems: Discrete Fourier transform (DFT), frequency domain sampling, Properties of DFT, Frequency

Module-III: (06 hours)
Efficient computation of DFT: circular convolution, circular correlation, linear filtering methods based on DFT.
Fast Fourier transform (FFT): Decimation in time (DIT) algorithm, Decimation in frequency (DIF) algorithm, Application of FFT.

Module-IV: (08 hours)
Realization of FIR and IIR systems using direct forms and cascaded forms. Design of Digital filters: General considerations. Design of FIR filters: window method.
Design of IIR filters: Impulse invariance method, bilinear transformation method for analog filters.

Module-V: (04 hours)
Basic adaptive filter: Structure of Adaptive FIR filter, System Modeling and Inverse Modelling. Application of DSP.

Course Outcome:
Upon completion of the course, the students will be able to:
CO1: Analyze and characterize signals and systems.
CO2: Analyze digital systems in time and frequency domain.
CO3: Demonstrate digital system characterization through DFT and FFT.
CO4: Implement digital filters and systems.
CO5: Demonstrate adaptive signal spectral estimation methods

Text Books:

1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, Pearson.tion, Sammuel Y, Liao, Perason Education
2. Digital Signal Processing - Dr. Shalia D. Apte, Willey Publication
3. Digital Signal Processing: Tarun Kumar Rawat, Oxford University Press.
4. Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, Tata McGrawHill.
5. Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, Tata McGraw Hill.