5th Semester	REC5C001	Digital Signal Processing	L-T-P 3-0-0	3 CREDITS

Digital Signal Processing

MODULE I **(14 HOURS)**

Discrete Time System
Basic Discrete Time Signals and their classifications, Discrete times systems and their classifications, Stability of discrete time system, Analysis and response (convolution sum) of discrete - time linear LTI system, Recursive and Non-recursive discrete time system, impulse response of LTI system, Correlation of discrete timeSignal.

The Z-Transform and Its Application to the Analysis of LTI Systems: The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain: Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability,Pole-Zero Cancellations.

MODULE II **(12 HOURS)**

The Discrete Fourier Transform: Its Properties and Applications, Frequency Domain Sampling: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT; The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform.

Efficient Computation of the DFT: Fast Fourier Transform Algorithms, Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N- Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.

MODULE III **(10 HOURS)**

Structure and implementation of FIR and IIR filter: Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct- Form Structure, Cascade-Form

Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.

Design of Digital Filters: General Considerations: Causality and Its Implications, Characteristics of Practical Frequency- Selective Filters; Design of FIR Filters: Symmetric and Anti-symmetric FIR Filters, Design of Linear- Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. Basic adaptive filter: System modelling and Identifications using adaptive filter.

Books:

[1] Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4thEdition, Pearson.
[2] Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, Tata McGrawHill.
[3] Digital Signal Processing: Tarun Kumar Rawat, Oxford University Press.
[4] Digital Signal Processing: T.J.Cavicchi, WieleyStudentEdition.
[5] Digital Signal Processing: P. Ramesh Babu, Edition 3, Scitech publications, 2001

Digital Learning Resources:

Course Name:	Digital Signal Processing
Course Link:	https://nptel.ac.in/courses/108/106/108106151/
Course Instructor:	Prof. C.S Ramalingam, IIT Madras