

DIGITAL SIGNAL PROCESSING

Code : EC 512(EI)

Credits : 4

Module I

Description of Signals and Systems: Types of signals and their characteristics, types of systems and their behavior.

Discrete-time description of signals: Discrete-time sequences, their frequency domain behaviour, comparison with analog signals, convolution of two sequences, sampling a continuous function to generate a sequence, reconstruction of continuous-time signals from discrete-time sequences.

Module II

Discrete-time description of systems: Unit-sample response of a system, Time-invariant systems, Superposition principle for linear systems, Stability criterion for discrete-time systems, Causality criterion for discrete-time systems, Linear constant-coefficient difference equations.

Module III

Discrete-time Fourier transform: Definition of Fourier transform (FT), important properties of FT, properties of FT for real-valued sequences, use of FT in signal processing, FT of special sequences, the inverse FT, FT of the product two discrete-time sequences

Discrete Fourier Transform: The definition of the Discrete Fourier Transform (DFT), computation of the DFT from the discrete-time sequence, properties of the DFT, circular convolution, performing a linear convolution with the DFT, computations for evaluating the DFT

Module IV

Z-transform: Definition of the z-transform, properties of the z-transform, the system function of a digital filter, combining filter sections to form more complex filters, digital filter implementation from the system function

Relationship between the Fourier transform and the z-transform, the z-transform of symmetric sequences, the inverse z-transform

Module V

Digital filter: Definition and anatomy of a digital filter, frequency domain description of signals and systems, typical applications of digital filters, replacing analog filters with digital filters, filter categories: IIR and FIR, recursive and non-recursive

Digital Filter Structures: The direct form I and II structures, Cascade combination of second-order sections, parallel combination of second-order sections, Linear-phase FIR filter structures, Frequency-sampling structure for the FIR filter.

Effect of word length: Round off error, truncation error, quantization error, limit cycle