

Course Objectives : This course is aimed to develop an understanding of signals, mathematical operation on signals and digital filters.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to analyse signals using the discrete Fourier transform (DFT).
2. Understand circular convolution, its relationship to linear convolution, and how circular convolution can be achieved via the discrete Fourier transform.
3. Able to understand the decimation in time and frequency FFT algorithms for efficient computation of the DFT.
4. Able to understand the characteristics of IIR and FIR filters and learn the design of infinite and finite impulse response filters for filtering undesired signals.
5. Able to implement digital filters in a variety of forms:-Direct form I & II, Parallel, Cascade and lattice structure.
6. Able to understand the finite word length effects.

Topics Covered

UNIT-I

Discrete Fourier Transforms: Definitions, Relation between DTFT and DFT, Computational problem, Properties of the DFT, Circular Convolution, Linear Convolution 9

Fast Fourier Transform Algorithms: Introduction, Radix-2 Decimation in Time (DIT) Algorithm, Radix-2 Decimation in Frequency (DIF) Algorithm, Computational Efficiency of DIT and DIF algorithms.

UNIT-II

IIR Filter Design: Analog filter design-Butterworth and Chebyshev filter; Discrete time IIR filter design techniques: Impulse Invariance, Bilinear transformation, Approximation of derivatives, (LPF, HPF, BPF, BRF) filter design using frequency translation technique 9

UNIT-III

FIR Filter Design: Characteristics of FIR Digital Filters, Phase and Frequency Response; FIR Filter design using Fourier Series Method, Frequency Sampling Technique, Effect of Windowing, Windowing Techniques-Rectangular Window, Hamming Window, Hanning Window, Blackman Window, Kaiser Window 9

UNIT-IV

Realization of Discrete Time Systems: FIR Systems: Direct form, cascade, parallel and lattice structures, Realization of Linear Phase FIR Systems; IIR systems: Direct form, cascade, parallel, Transposed Forms, ladder structure realization 9

Finite Word length Effects: Rounding and Truncation Errors, Quantization Effects in Analog-to-Digital Conversion of Signals, Quantization effect in filter coefficients

Text and Reference Books