

EC431 DIGITAL SIGNAL PROCESSING**Course Description and Objectives:**

This course will introduce the students the fundamental concepts of Discrete Time Signal processing and its algorithms for real time implementation of communication systems. Students will learn the algorithms useful for real time signal processing applications.

Course Outcomes:

Upon successful completion of this course, students should be able to:

- Analyze signals using Z-Transform*
- Analyze signals using the discrete Fourier transform (DFT).*
- Understand circular convolution, its relationship to linear convolution, and how linear convolution can be achieved via the discrete Fourier transform.*
- Understand the Decimation in time and frequency FFT algorithms for efficient computation of the DFT.*
- Design digital IIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation.*
- Design digital FIR filters using the window method.*

UNIT I - Introduction to Discrete Signals and Systems :

Introduction: Review of Signals and Systems, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations: Impulse response, step response, response to arbitrary inputs. Frequency domain representation of discrete time signals and systems: Z-Transform and properties, analysis of linear time invariant systems using Z-domain.

Unit II - Fourier Analysis of Discrete Time Signals :

Frequency Analysis of Discrete Time Signals: Discrete Fourier representation of periodic sequences(DTFT), Properties, Frequency response.Discrete Fourier Transform: Discrete Fourier transforms, Properties of DFT, linear convolution of sequences using DFT, Computation of DFT.

UNIT III - Fast Fourier Transform :

Fast Fourier Transform: Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT, Radix-4 FFT, Filtering of long data sequences: Overlap save and overlap add methods.

UNIT IV - FIR Filter Design and Realization :

FIR Filter Design & Realization: FIR System function, Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique. Structures of FIR: Direct form structure, cascade form structure, Linear Phase structure, signal flow graphs and transposed structures.

UNIT V - IIR Filter Design and Realization :

IIR Filter Design & Realization: IIR System Function, Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Analog-to- Digital transformations. Structures of IIR : Direct form I and II, cascade form, parallel form, signal flow graphs and transposed Structures. Comparison of IIR & FIR filters.

TEXT BOOKS :

1. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", Pearson Education / PHI, 2007.
2. A.V.Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", PHI, 1997.

REFERENCE BOOKS :

1. Ramesh Babu, "Digital Signal Processing", Scitech, 2003.
2. M H Hayes, "Digital Signal Processing : Schaum's Outlines", TATA McGraw Hill, 2007.
3. Alan V. Oppenheim, Ronald W. Schafer, "Digital Signal Processing", PHI, 2006.
4. Salivahanan, Vallavaraj, Gnanapriya, "Digital Signal processing", TMH, 2000.