**IV Year B.Tech. EEE  I - Semester**                    **L  T  P  TO  C**
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## EE421 DSP AND ITS APPLICATIONS

*Course Description & Objectives:*

*To understand the representation of discrete time signals and systems with discrete inputs both in time domain and frequency domain as these constitute basics for DSP. To study both direct and inverse Z-Transforms, DFT (Discrete Fourier Transforms), FFT (Fast Fourier Transforms) and their properties in detail. To design and realize various Infinite Impulse Response (IIR) & Finite Impulse Response (FIR) filters and study their properties. To provide idea about DSP based applications and Wavelet transforms.*

*Course Outcomes:*

l   *Determine whether a discrete time system is linear, time-invariant, causal, and stable.*
l   *Apply DFT to discrete systems; evaluate DFT using fast Fourier transforms (FFT).*
l   *Design FIR and IIR filters and realize digital filters.*
l   *Understand signal processing in DSP based applications.*

### UNIT I - Introduction:

Review of Signals and Systems, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems, Review of Z-Transform and properties, Discrete fourier representation of periodic sequences.

### UNIT II - Frequency Transformations:

Introduction to DFT – Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering.

### UNIT III - IIR Filter Design:

Structure of IIR – Analog filter Design - Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (HPF, BPF, BRF) filter design using frequency translation. Realization of IIR Filters- Direct form, Cascade form, Signal flow graph and Transposed structure, Application in speed controller design.

**UNIT IV - FIR Filter Design:**

Structures of FIR – Linear phase FIR filter – Filter design using windowing techniques, Frequency sampling techniques – Finite word length effects in digital Filters, Comparison of IIR and FIR. Realization of FIR filters- Direct form, Cascade form and linear phase realization, Application in speed controller design.

**UNIT V - Applications:**

Introduction to Speech processing, Image Processing, Digital Signal Processing Based Speed Control of Industrial Motor Drive, power system protection and planning, Importance in building smart grid.

**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. G. Strang and T. Q. Nguyen, "Wavelets and Filter Banks," Wellesley-Cambridge Press, Revised Edition, 1998.