# ADVANCED DIGITAL SIGNAL PROCESSING

**Course Code:** 13EC2102 **L P C**
**4 0 3**

**Pre requisites**: Digital Signal Processing

**Course Educational Objectives:**

1. To understand DFTs and FFTs.
2. To know about IIR and FIR filter design.
3. To be acquainted with Multi Rate Signal Processing.
4. To understand power spectral estimation and finite word length effects in DSP.

**Course Outcomes:**

Upon completion of the course, the student will be able to

1. Demonstrate basic filters and different multirate conversion methods.
2. Compute the power spectrum.
3. To understand the Finite Word length Effects in Fixed-Point DSP Systems.

**UNIT-I**

**DISCRETE AND FAST FOURIER TRANSFORMS:**

Properties of DFT, Linear Filtering methods based on the DFT, Overlap-save, Overlap -Add methods, frequency analysis of signals, Radix-2 FFT and Split- Radix FFT algorithms The Goertzel and Chirp Z transform algorithms.

**UNIT-II**

**DESIGN OF IIR AND FIR FILTERS:**

Design of IIR filters using Butterworth &Chebyshev approximations, frequency transformation techniques, structures for IIR systems – cascade, parallel, lattice & lattice-ladder structures, Fourier series method, Windowing techniques, design of digital filters based on least – squares method, pade approximations, least squares design, wiener filter methods, structures for FIR systems –cascade, parallel, lattice & lattice-ladder structures.

**UNIT-III**

**MULTI RATE SIGNAL PROCESSING:**

Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Filter design & Implementation for sampling rate conversion, filter bands, sub band coding, polyphase filters.

**UNIT-IV**

**POWER SPECTRAL ESTIMATION:**

Estimation of spectra from finite duration observation of signals, Non-parametric methods: Bartlett, Welch &Blackman&Tukey methods. Relation between auto correlation & model parameters, Yule-Waker& Burg Methods, MA & ARMA models for power spectrum estimation.

**UNIT-V**

**ANALYSIS OF FINITE WORD LENGTH EFFECTS IN FIXED-POINT DSP SYSTEMS:**

Fixed, Floating Point Arithmetic – ADC quantization noise & signal quality – Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

**TEXTBOOKS:**

[1] J.G.Proakis&D.G.Manolokis, "*Digital Signal Processing – Principles, Algorithms Applications*", PHI.

[2] Alan V Oppenheim & Ronald W Schaffer, "*Discrete Time signal processing*", PHI.

**REFERENCE BOOKS:**

[1] S. M .Kay, "*Modern spectral Estimation techniques*", PHI, 1997.Emmanuel C. Ifeacher Barrie. W. Jervis, "DSP – A Practical Approach", Pearson Education.