ADVANCED DIGITAL SIGNAL PROCESSING

Course Code: 13EC2102

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Course Outcomes:

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

CO1: Comprehend the DFTs and FFTs.

CO2: Design and Analyze the digital filters.

CO3: Acquire the basics of multi rate digital signal processing.

CO4: Analyze the power spectrum estimation (4 or 5 methods).

CO5: Comprehend 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 banks, 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-Walker& 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.