ADVANCED DIGITAL SIGNAL PROCESSING

Course Code:15EC2102

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Pre requisites: Digital Signal Processing

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 multirate 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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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. Proakis, John G. "*Digital signal processing: principles, algorithms, and application-3/E*." 1996.
2. Oppenheim, Alan V., Ronald W. Schafer, and John R.Buck. *"Discrete-time signal processing*." Vol. 2. Englewood Cliffs: Prentice-hall, 1989.

REFERENCE BOOKS:

1. S. M .Kay, "*Modern spectral Estimation techniques*", PHI, 1997.
2. Ifeachor, Emmanuel C., and Barrie W. Jervis. "*Digital signal processing: a practical approach*." Pearson Education, 2002.