ADVANCED DIGITAL SIGNAL PROCESSING
(ELECTIVE – I)

Course Code:13EE2206

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Pre requisites: Basic Knowledge of Signals and Systems and Digital Signal Processing.

Course Educational Objectives: To make the student understand Digital filters structures, Digital filter design, DSP algorithms, Finite word length effects, error analysis and power spectrum estimation.

Course Outcomes: At the end of the course, the student will be able to
1. Demonstrate realization of different structures of IIR and FIR Filters.
2. Describe Spectral transformations of IIR filters
3. Design computationally efficient FIR digital filters
4. Identify Quantization process, arithmetic round off and signal-to-noise ratio in low order IIR filters
5. Analyze errors and Estimate power spectrum using various methods

UNIT-I
DIGITAL FILTER STRUCTURES:
Block diagram representation-Equivalent Structures- IIR digital filter Structures All Pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures--Computational complexity of digital filter structures.
Block diagram representation- Equivalent structure- FIR digital Filter Structures FIR cascaded Lattice Structures – Parallel- Digital Sine cosine generator-Computational complexity of digital filter structures.

UNIT-II
IIR DIGITAL FILTER DESIGN
Preliminary considerations-Bilinear transformation method of IIR filter design-design of Low pass, high pass, Band pass, and Band stop- IIR digital filters-Spectral transformations of IIR filters.

UNIT-III
FIR DIGITAL FILTER DESIGN
FIR filter design-based on Windowed Fourier series- computer aided design of Equiripple Linear Phase FIR filters- design of minimum phase FIR filters- design of computationally efficient FIR digital filters

UNIT-IV
DSP ALGORIRHM AND FINITE WORD LENGTH EFFECTS
Computation of the discrete Fourier transform- Number representation-Arithmetic Operations-handling of overflow-Tunable digital filters-function approximation.
The Quantization process and errors- Quantization of fixed -point and floating –point Numbers-Analysis of coefficient Quantization effects - Analysis of Arithmetic Round-off errors-Dynamic range scaling signal-to- noise ratio in Low -order IIR filters-Low-Sensitivity Digital filters

UNIT- V
ERRORS ANALYSIS AND POWER SPECTRUM ESTIMATION
Reduction of Product round-off errors using error feedback-Limit cycles in IIR digital filters-Round-off errors in FFT Algorithms.
Estimation of spectra from Finite Duration Observation of signals – Non-parametric methods for power spectrum Estimation–parametric method for power spectrum Estimation-Estimation of spectral form-Finite duration observation of signals-Non-parametric methods for power spectrum estimation-Welch methods-Blackman & Tukey method.

TEXT BOOKS:
1. Sanjit K. Mitra , "*Digital signal processing*",2nd Edn, TMH, 1997
   (UNITS – I, II, III, IV)
2. John G.Proakis, "Digital *Signal Processing principles, algorithms and Applications*", 3rd Edn. PHI, 2002. (UNITS – V)

REFERENCE BOOKS:
1. Alan V.Oppenheim, Ronald W.Shafer, "*Discrete Time Signal Processing*", 1st Edition. PHI, 1996.
2. S.Salivahanan, A.Vallavaraj, C. Gnanapriya , "*Digital Signal Processing* ", 2nd Edition, TMH, 2001
3. Lourens R. Rabinar & Bernard Gold, "*Theory and Applications of Digital Signal Processing*", 2nd Edition, TMH, 2001
4. Andreas Antoniou,"*Digital Filter Analysis and Design*", TMH, 2001