OBJECTIVES:
The purpose of this course is to provide in-depth treatment on methods and techniques in
• discrete-time signal transforms, digital filter design, optimal filtering
• power spectrum estimation, multi-rate digital signal processing
• DSP architectures which are of importance in the areas of signal processing, control
and communications.

OUTCOMES:
Students should be able to:
• To design adaptive filters for a given application
• To design multirate DSP systems.

UNIT I  DISCRETE RANDOM SIGNAL PROCESSING  9
Weiner Khitchine relation - Power spectral density – filtering random process, Spectral
Factorization Theorem, special types of random process – Signal modeling-Least
Squares method, Pade approximation, Prony’s method, iterative Prefiltering, Finite Data
records, Stochastic Models.

UNIT II  SPECTRUM ESTIMATION  9
Non-Parametric methods - Correlation method - Covariance estimator - Performance
analysis of estimators – Unbiased consistent estimators - Periodogram estimator -
Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA,
ARMA Signal modeling – Parameter estimation using Yule-Walker method.

UNIT III  LINEAR ESTIMATION AND PREDICTION  9
Maximum likelihood criterion - Efficiency of estimator - Least mean squared error
criterion - Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman
filter – Linear prediction, Prediction error - Whitening filter, Inverse filter - Levinson
recursion, Lattice realization, Levinson recursion algorithm for solving Toeplitz system of
equations.

UNIT IV  ADAPTIVE FILTERS  9
FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on
steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel
equalization - Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive
filters - Exponentially weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive
filter.

UNIT V  MULTIRATE DIGITAL SIGNAL PROCESSING  9
Mathematical description of change of sampling rate - Interpolation and Decimation –
Continuous time model - Direct digital domain approach - Decimation by integer factor -
Interpolation by an integer factor - Single and multistage realization - Poly phase
realization - Applications to sub band coding - Wavelet transform and filter bank
implementation of wavelet expansion of signals.

L +T= 45+15, TOTAL: 60 PERIODS
REFERENCES:


