GUJARAT TECHNOLOGICAL UNIVERSITY

Signal Processing and VLSI Technology(EC)

M.E. Semester: II

Subject Name: **Advanced Digital Signal Processing and Applications**

Sr. No.	Course Content
1.	**Discrete Random Signal Processing :** Discrete Random Processes- Stationary Random processes, Ensemble Averages, discrete time random signals, Bias and Estimation, Autocovariance, Autocorrelation, Parseval's theorem, Wiener-Khintchine relation, White noise, Power Spectral Density, Filtering Random Processes, Special types of Random Processes : AR,MA ,ARMA processes and power spectral estimation, Yule-Walker equations
2.	**Linear Estimation And Prediction :** Linear prediction – Forward and Backward predictions, Solution of normal equations- Levinson-Durbin algorithm, Least mean-squared error criterion, Properties of the Linear Prediction error filters, AR Lattice and ARMA Lattice-Ladder filters,
3.	**Linear Optimum Filters:** Wiener filter for filtering and prediction, FIR and IIR Wiener filters, Noncausal Wiener filter, Discrete Kalman filter
4.	**Adaptive filters:** Need for adaptive filtering, approaches of adaptive filtering, direct form of adaptive filter, applications of adaptive filters. Adaptive Direct form FIR filters: LMS algorithm, adaptive filter based on steepest descent method- RLS adaptive algorithms and properties, Adaptive Lattice Ladder Filters.
5.	**Multirate Digital Signal Processing** : Fundamentals of Multirate Systems :- Introduction, The sampling theorem,Sampling of discrete time signals, basic multirate operations, interconnection of building blocks, Interpolation and Decimation, Decimation by an integer factor, Interpolation by an integer factor, Sampling rate conversion by a rational factor. Polyphase filter structures,CIC fiters, Multistage implementation of multirate system, Sampling rate conversion of Bandpass signals, Subband coding of Speech Signals ,digital filter banks,Quadrature Mirror Filters(QMF).Applications of Multirate Signal Processing ,Fourier and Z Transforms of Multidimensional Signals.

Reference Books:

1. **J.G. Proakis and D.G. Manolakis** - Digital Signal Processing: Principles Algorithms and Applications,4th Edition Pearson Education, 2007
2. **S.K. Mitra** - Digital Signal Processing: A computer based approach, TMH, 2001
3. **S. Haykin**, Adaptive Filter Theory, Pearson, 1996
4. **P.P. Vaidyanathan**, Multirate systems and Filter banks, Pearson,1996
5. **Bernard Widrow,Samuel D.Stearns**, Adaptive Signal Processing, Pearson, 2006
6. **Emmanuel Ifeachor**,Barry Jervis Digital Signal Processing,2nd Edition, Pearson Education, 2002
7. **Li Tan** , Digital Signal Processing fundamentals and applications, Elsevier