

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering (Signal Processing & Communication)

Semester: IV

Subject Code : 744101

Subject Name : Advanced Topics in Signal and Image Processing

Sr. No.	Course Content
1	Spectrum Estimation: Random Signal and Random Process, Computation of Energy Density Spectrum, Power Spectrum of Random Process – The Periodogram, Use of DFT in Power Spectrum Estimation, Nonparametric Methods for Power Spectrum Estimation – The Barlett Method and The Welch Method, Parametric Methods for Power Spectrum Estimation - Spectrum Estimation Based on Autoregressive Models, Spectrum Estimation Based on Moving Average Models, Spectrum Estimation Based on Autoregressive Moving Average Models
2	Wavelet Transform: Short-Time Fourier Transform, Wavelet Transform, Restrictions on Mother Wavelets, Haar Wavelet and Multiresolution Analysis, Daubechies Wavelets, Other Standard Wavelets, Applications of Wavelet Transform
3	Multivariate Analysis: Introduction, Background Mathematics – Variance, Covariance, Covariance Matrix, Eigenvectors and Eigenvalues, Principal Components Analysis (PCA): Solving PCA using Eigenvector Decomposition and General Solution using SVD, Independent Component Analysis (ICA), Cluster Analysis: Hierarchal Clustering and Partitional Clustering
4	Image Representation and Feature Extraction: Run-Length Coding, Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeletons Feature Vectors and Vector Spaces, Binary Object Features, Fourier Descriptors, Shape Number and Hierarchical Features, Histogram-based (Statistical) Features, Texture Features, Hough Transform
5	Visual Pattern Recognition: Design and Implementation of a Visual Pattern Classifier, Patterns and Pattern Classes, Data Preprocessing, Training and Test Sets, Confusion Matrix, Hit Rates, False Alarm Rates, and ROC Curves, Precision and Recall, Distance and Similarity Measures, Minimum Distance Classifier, k-Nearest Neighbors Classifier, Bayesian Classifier

Reference Books

1. Title: Digital Signal Processing
Author(s): J.G.Proakis, D.G.Manolakis
Publisher:Prentice-Hall India
2. Title: Digital Signal Processing
Author(s): Dr. Shaila D.Apte
Publisher:Wiley
3. Title: Digital Image Processing
Author(s): R.C.Gonzalez & R.E.Woods
Publisher:Pearson Education
4. Title: Image Processing & Pattern Recognition
Author(s): F.Y.Shih
Publisher:Wiley
5. Title: Practical Image and Video Processing using MATLAB
Author(s): O.Marques
Publisher:Wiley