

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Semester: I

## Signal Processing and VLSI Technology(EC)

Subject Name: Wavelet Transform and Applications (Major Elective – I)

Sr.No	Course content
1.	<b>Introduction:</b> Origin of wavelets and its history, Different communities of wavelet, classification-continuous and discrete wavelet transforms, developments in wavelet theory applications
2.	<b>Continuous Wavelet Transform-</b> Introduction, Continuous time wavelets, Definition of CWT, Constant Q factor filtering interpretation and Time Frequency Resolution ,CWT as an operator, inverse CWT
3.	<b>Introduction to the Discrete Wavelet Transform and orthogonal Wavelet decomposition:</b> Approximations of vectors in nested linear vector subspaces, Multiresolution Analysis of $L^2(\mathbb{R})$ ,Haar Scaling function, Haar wavelet, Haar wavelet decomposition.
4.	<b>MRA Orthonormal wavelets and their relationships to filter banks:</b> Construction of an orthonormal MRA, wavelet basis for the MRA, Digital filtering interpretation, Examples of orthogonal basis generating wavelets, interpreting orthonormal MRA for discrete time signals ,generating scaling functions and wavelets from filter coefficients.
5.	<b>Biorthogonal Wavelets:</b> Biorthogonal Wavelet bases, Filtering relationship for Biorthogonal filters, Biorthogonal scaling functions and wavelets, Two dimensional wavelets, Nonseparable Multidimensional wavelets,Wavelet Packets.
6.	<b>Wavelength Transform and applications:</b> Transform coding, DTWT for image compression, audio compression ,Wavelet based audio coding, video coding and multiresolution Techniques, wavelet denoising,Speckle removal, Edge detection and object isolation, Image fusion, Object detection, discrete wavelet multitone modulation.
7.	<b>Beyond Wavelet: Ridgelets and curvelets:</b> Ridgelet transform and Digital Curvelet transform, Curvelet construction, properties and applications.

**Reference Books:**

1. Raguveer M.Rao and Ajit S.Bopardikar-Wavelet Transforms –Introduction and applications-Pearson Education, 2008
2. K.P Soman,K.I.Ramachandran –Insight into Wavelets from Theory to practice, PHI 2006