Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NMCD539	Wavelets: Theory and Applications	3	0	0	3

Course Objective
Wavelets have established themselves as an important tool in modern signal processing as well as in applied mathematics. The objective of this course is to establish the theory necessary to understand and use wavelets and related constructions.
Learning Outcomes
Wavelet analysis can be defined as an alternative to the classical windowed Fourier analysis. In the latter case the goal is to measure the local frequency content of a signal, while in the wavelet case one is comparing several magnifications of this signal, with distinct resolution.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Fourier analysis: Fourier and Inverse Fourier Transforms, Continuous-Time Convolution and the Delta Function, Fourier Transform of Square Integrable Functions, Fourier Series. Basic Convergence Theory and Poisson's Summation Formula.	8	To study Fourier transforms, Fourier series and their basic properties.
2	Wavelet Transforms and Basic Properties: The Gabor Transform. Basic Properties of Gabor Transforms. The Integral Wavelet Transforms, Dyadic Wavelets and Inversions. Basic Properties of Wavelet Transforms.	8	To study wavelets and wavelet transforms with examples. The basic ideas and properties of wavelet transforms are discussed with special attention given to the use of different wavelets for resolution and synthesis of signals.
3	The Discrete Wavelet Transforms. Orthonormal Wavelets, Wavelet frames & Multiband, Curvelets. Scaling Functions and Wavelets: Definition of Multiresolution Analysis and Examples.	9	In this unit the orthonormal wavelet transform is implemented in the multiresolution signal analysis framework, which is based on the scaling functions.
4	Properties of Scaling Functions and Orthonormal Wavelet Bases. Construction of Orthonormal Wavelets.	9	To study the concept of scaling functions and orthonormal wavelet bases. This is followed by a method of constructing orthonormal basis of wavelets from multiresolution signal analysis.
5	Daubechie's Wavelets and Algorithms.	8	In this unit, Daubechies wavelets and algorithms has been emphasized. This unit deals with the theory and construction of orthonormal wavelets with compact support which have many interesting properties.
	Total	**42**	

Text Books:

1. C. K. Chui, An Introduction to Wavelets, Academic Press, New York (1992).
2. L. Debnath, Wavelet transforms and their applications, Birkhauser, Boston, MA, (2002).

Reference Books:

1. Daubechies, Ten lectures on wavelets,In: CBMS-NSF Regional Conference Series in Applied Mathematics, SIAM Publication, Philadelphia, PA, (2006).
2. Hernandez and G. Weiss, A first course on wavelets, CRC Press, 1999