WAVELET THEORY

Course Code: **MM24308DCE** Total Credits: **04**
Semester: **MA/M.Sc. 3rd Semester** Total Marks: **100**
Continuous Assessment: **Marks 20,** Theory: **Marks 80** Time Duration: **2½ hrs**

Course Objectives: To inculcate the students about Wavelet theory through different types of wavelets and their properties.
Course Outcome: The students after the completion of this course shall be able to apply wavelet transforms and their properties in understanding the signals in both time and frequency domains.

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Unit –I

Time Frequency Analysis and Wavelet Transforms: Gabor transforms, basic properties of Gabor transforms, continuous and discrete wavelet transforms with examples, basic properties of wavelet transforms, examples of Haar wavelet, Mexican hat wavelet and their Fourier transforms, dyadic orthonormal wavelet bases for $L^2(\mathrm{R})$.

Unit –II

Multiresolution Analysis and Construction of Wavelets: Definition and examples of multiresolution analysis (MRA), properties of scaling functions and orthonormal wavelet bases, construction of orthonormal wavelets with special reference to Haar wavelet, Franklin wavelet and Battle- Lemarie wavelet, Spline wavelets, construction of compactly supported wavelets, Daubechie's wavelets and algorithms.

Unit –III

Other Wavelet Constructions and Characterizations: Introduction to basic equations, some applications of basic equations, characterization of MRA wavelets and scaling functions, construction of biorthogonal wavelets, wavelet packets, definition and examples of wavelets in higher dimensions.

Unit –IV

Further Extensions of Multiresolution Analysis: Periodic multiresolution analysis and the construction of periodic wavelets, multiresolution analysis associated with integer dilation factor (M-band wavelets), harmonic wavelets, properties of harmonic scaling functions.

Books Recommended

1. L. Debnath, Wavelet Transforms and their Applications, Birkhauser, 2002.
2. I. Daubechies, Ten Lectures on Wavelets, CBS-NSF Regional Conferences in Applied Mathematics, 61, SIAM, Philadelphia, PA, 1992.
3. K. Ahmad and F. A. Shah, Introduction to Wavelets with Applications, Real World Education Publishers, New Delhi, 2013.
4. C. K. Chui, An Introduction to Wavelets, Academic Press, New York, 1992.
5. M. Pinsky, Introduction to Fourier Analysis and Wavelets, Brooks/Cole, 2002.E. Hernandez and G. Weiss, A First Course on Wavelets, CRC Press, New York (1996).