

OPTION (D). WAVELETS

(Questions will be set from each unit/section)

Units	Topics
I	Preliminaries Different ways of constructing wavelets - Orthonormal bases generated by a single function, the Balian - Low theorem. Smooth Projections on $L^2(\mathbb{R})$. Local sine and cosine bases and the construction of some wavelets. The unitary folding operations and the smooth projections.
II	Multi resolution analysis and construction of wavelets construction of compactly supported wavelets and estimates for its smoothness. Band limited wavelets. Orthonormality. Completeness. Characterization of lemarié meyes wavelets and some other characterizations.
III	Franklin Wavelets and Spline wavelets on the real line. orthonormal bases of piecewise linear continuous functions for $L^2(\mathbb{T})$. Orthonormal bases of periodic splines. Periodization of wavelets defined on the real line.
IV	Characterizations in the theory of wavelets the basic equs and some of its applications. Characterizations of MRA wavelets. low - pass filters and scaling functions. Non-existence of smooth wavelets in $H^2(\mathbb{R})$. Frames - The reconstruction formula and the Balian Low theorem for frames. Frames from translations and dilations. Smooth frames for $H^2(\mathbb{R})$.
V	Discrete transforms and algorithms - the discrete and the fast fourier transforms. The discrete and the fast cosine transforms. The discrete version of the local sine and cosine bases. Decomposition and reconstruction algorithms for wavelets.