MATH 379/579
Fourier Analysis with Applications (3 units)

Course Outline

Sections	Topics	# of weeks
0.1–0.5	**Preliminaries:** Inner product spaces; the spaces $\mathbb{C}^n$, ℓ^2, and $L_2[a,b]$; types of convergence of functions; orthogonality and orthogonal projections.	2.0
1.1–1.3	**Fourier Series:** Fourier cosine and sine expansions; complex form; the Riemann–Lebesgue lemma; convergence of Fourier series; Parseval's identity and Bessel's inequality; applications to PDEs.	5.0
2.1–2.5	**The Fourier Transform:** Definition and basic properties; Fourier inversion; Plancherel's theorem; the Shannon–Whittaker sampling theorem; the Uncertainty Principle. Sections 2.3–2.5 are covered as time permits.	2.5
4.1–4.2	**The Haar Wavelet:** The Haar scaling function and its basic properties; the Haar wavelet.	1.0
5.1–5.2	**Multiresolution Analysis:** Definition; the scaling relation; the associated wavelet and wavelet spaces; decomposition and reconstruction formulas; implementation.	2.5
	Tests	1.0

Textbook: *A First Course in Wavelets and Fourier Analysis*, 2nd edition.
By A. Boggess and F.J. Narcowich.

Adopted: Spring 2013.