



## APPLIED MATHEMATICS 503 "The Mathematics of Wavelets, Signal and Image Processing"

**Calendar Description: H(3-1T)**

Continuous and discrete Fourier transforms, the Fast Fourier Transform, wavelet transforms, multiresolution analysis and orthogonal wavelet bases, and applications.

**Prerequisite:** Applied Mathematics 491 or Computer Science 491.

**Corequisite:** Applied Mathematics 371.

### *Syllabus*

<u>Topics</u>	<u>Number of Hours</u>
Review of linear algebra for inner product spaces: inner product, norms, linear subspaces, linear independence, orthogonal and orthonormal bases, Gram-Schmidt, convergence in norm, infinite orthogonal bases	3
Fourier series for real-valued functions on an interval: definition and properties, uniform and pointwise convergence, Parseval's theorem, L2 convergence	6
Discrete and Fast Fourier Transforms (transforms on a finite cyclic group): forward and inverse transform, cyclic convolution, convolution theorem, 2D transforms	6
Fourier transform on the real line: definition and properties, Riemann-Lebesgue lemma, inverse transform, convolutions and time-invariant systems, Plancherel's theorem	6
Representing signals: on the real line, discretely sampled, A/D and D/A conversion, the Shannon sampling theorem, aliasing, time-invariant filtering, convolution and the Fourier transform	6
Introduction to wavelets: the Haar wavelet, scaling function and wavelet function. Haar decomposition and reconstruction, multiresolution analysis. Compactly supported wavelets	9
<b>TOTAL HOURS</b>	<b>36</b>

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