SYLLABUS FOR MATH 464, FALL 2006

Tuesday, Thursday 9:30 a.m. - 10:45 a.m.

MTH 0411

Prerequisite: MATH 246 and 400-level mathematics or electrical engineering courses, perhaps taken concurrently.

Text: "Harmonic analysis and applications" by J. J. Benedetto. Published by CRC. ISBN: 0849378796 (Current) + notes from instructor.

Instructor: Dr. Wojciech Czaja

Office: MTH 4406

Office Hours: Tuesday, Thursday 11 a.m. - noon, or by appointment

Phone: (301) 405 - 5106

Exams: There will be three midterm exams during the semester, each for the total of 50 points: October 3, November 7, December 7. The final exam is scheduled for December 15th, 8 a.m. - 10 a.m. It is worth 100 points.

Calculators: Calculators will NOT be allowed for the exams or quizzes, but small (5 x 3 in.) note cards will be allowed during the exams.

Quizzes and Homework: Each Thursday of the week that has no exam scheduled, there will be either a homework or a quiz assigned. (Homeworks are due the next Tuesday.) Each one is worth 10 points, and there will 10 of such assignments.

Grading: The maximum point total is 350 points and the total used to calculate the final grade is the minimum of the two numbers: 350 points and the largest score in the class. The setting of letter grades will be based on the number of points and will be no worse than: 50% - D, 60% - C, 75% - B, 90% - A.

Students who obtain during the semester at least 225 points, receive A without attending the final. Students who obtain during the semester at least 200 points but not more than 224, may receive B without attending the final.

OUTLINE OF MATERIAL (A VERY AMBITIOUS ONE)

Fourier Transform (Algebraic properties of the Fourier transform: convolution, modulation, and translation. Analytic properties of the Fourier transform: Riemann-Lebesgue Lemma, transforms of derivatives, and derivatives of transforms. Inversion theory: Approximate identities, L1 inversion, Jordan's theorem, and examples. The L2 theory: Parseval's formula, Plancherel's theorem, and examples.

Fourier series (Representation theory: Dirichlet's theorem and examples. Differentiation and integration of Fourier series. The L1 and L2 theories. Absolutely convergent Fourier series and Wiener's inversion theorem. Gibbs phenomenon.)

Laplace transform (Review of complex variables. Algebraic properties of the Laplace transform. Analytic properties of the Laplace transform: regions of convergence, transforms of derivatives, and derivatives of transforms. Representation and inversion theory of the Laplace transform. Evaluation of the complex inversion formula by residues.)

Differential equations (Applications of Fourier transforms, Fourier series, and Laplace transforms to ODE's and PDE's. These include recent applications in signal processing, classical applicsations in mathematical physics, initial and boundary value problems, Bessel functions, etc.)

DFT and FFT (Definition and properties of the DFT. Description of the FFT algorithm, and examples. Applications with MATLAB.)

Wavelet theory and MATLAB (Shannon wavelets and the classical sampling theorem. Multiresolution and analysis wavelet orthonormal bases. Quadrature mirror filters and perfect reconstruction filter banks. Multidimensional results. Wavelet packets. Applications with the MATLAB Wavelet Toolbox.)