Math 827 - Fall 09
Classical and Modern Fourier Analysis I

Kansas State University
Department of Mathematics

Professor: Virginia Naibo, CW 232, vnaibo@math.ksu.edu

Prerequisite: Math 821 - Real Analysis, or instructor permission

Text: No required text as I will be using my own notes. Recommended reading:

- *Fourier analysis* by Javier Duoandikoetxea. American Mathematical Society, 2001.
- *Classical and Modern Fourier Analysis* by Loukas Grafakos. Pearson/Prentice Hall, 2004 (1st edition) or Springer, 2009 (2nd edition)
- *Harmonic analysis : real-variable methods, orthogonality, and oscillatory integrals* by Elias M. Stein. Princeton University Press, 1993.

Description of the course: This course is the first part of the sequence Math 827 and Math 828 (Classical and Modern Fourier Analysis II). These courses will include the following topics along with applications, historical references, current open problems, and connections of Fourier Analysis with other areas of Mathematics.

(a) Fourier Analysis on the torus: functions as signals, Fourier series, pointwise convergence, L^p-convergence, Fourier series of continuous functions, Gibbs phenomenon.

(b) Fourier transform: the Fourier transform on L^1 functions, the Schwartz class and tempered distributions, the Fourier transform on L^p-spaces, convergence of Fourier integrals.

(c) Maximal functions: weak type inequalities and almost everywhere convergence, interpolation theorems, Hardy-Littlewood maximal function, dyadic maximal function, boundedness properties of maximal functions.

(d) Singular integrals: The Hilbert transform and the Riesz transforms, homogeneous singular integrals and the method of rotations, Calderón-Zygmund decomposition and singular integrals, L^p-boundedness.

(e) Littlewood-Paley theory and multiplier theorems: Wavelets, characterizations of function spaces (Lebesgue spaces, Hardy spaces, Sobolev spaces, Besov spaces, Triebel-Lizorkin spaces), square functions, multipliers, singular integrals on function spaces

(f) Duality between H^1 and BMO.

(g) Weighted inequalities: A_p weights, reverse Hölder inequality for weights and consequences, weighted norm inequalities for singular integrals.

(h) T1 theorem: Cotlar's lemma, Carleson measures, applications of the T1 theorem.

For more details about the course, contact Professor Naibo at vnaibo@math.ksu.edu.