Introduction to Harmonic Analysis - Math 541
Spring 2016

• Instructor: Malabika Pramanik
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• Office hours: To be announced.

• Web page: The course website is
  http://www.math.ubc.ca/~malabika/teaching/ubc/spring16/math541/index.html
Homework assignments and all relevant course information (such as changes to office hours if any, or solutions to homework problems if needed) will be posted here.

• Text: There are no required textbooks. The following textbooks are recommended.
  – Classical and Modern Fourier Analysis, by L. Grafakos.

• Course outline: The core topics of the course are the following:
  1. Basic material concerning Fourier series, Fourier transform and Fourier inversion
     – Fourier basis for $L^2(\mathbb{T})$
     – Convolution
     – Approximate identities
     – Temperate distributions
     – Some applications
  2. Convergence of Fourier series
     – Decay of Fourier coefficients
     – Uniform convergence of Fourier series
– Pointwise convergence and almost everywhere divergence
– Norm convergence

3. Interpolation of operators
– Complex methods (Riesz-Thörin theorem, analytic interpolation)
– Real methods (Marcinkiewicz interpolation theorem)
– Applications (Hausdorff-Young inequality, Young’s convolution inequality, fractional integration, Hardy-Littlewood maximal theorem).

4. Singular integral operators
– Calderón-Zygmund kernels
– Some multiplier operators
– The Calderón-Zygmund decomposition
– $L^p$ boundedness of Calderón-Zygmund singular integral operators
– Homogeneous distributions, Hilbert transform, Riesz transform.

5. Littlewood-Paley theory
– Almost orthogonality in Hilbert spaces, Cotlar-Knapp-Stein lemma
– A square function that characterizes $L^p$
– Variations and applications

Time permitting, we will also consider other special topics.

• Lectures: Monday, Wednesday, Friday 11 am - 12 noon in Mathematics Annex 1118.

• Grading Policy: Homework problems will be posted regularly on the course website. In addition, you will be required to give a presentation in class on a topic relevant to the course material and agreed upon by yourself and the instructor. Your total score will be a weighted average of your homework and in-class presentation, with the breakdown as follows.

  Homework 75%
  Presentation 25%