

# MA433: Fourier Analysis

Autumn 2014

**Instructor:** Weijun Xu

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**Time and location:**

Mondays 1-2 in MS.03, Thursdays 12-1 in MS.B3.03, Fridays 10-11 in B3.02.

**Support class:** Fridays 3-4 in MS.04.

**Overview:**

1. **Fourier series:** periodic functions, Fejér and Dirichlet kernels, convergence properties, Gibbs phenomena,  $L^2$  space, applications.
2. **Fourier transform:** basic  $L^1$  and  $L^2$  theory, Schwartz distributions, applications to constant coefficient PDEs.
3. **A selection of more advanced topics:** Characteristic functions and their use in probability; finite Fourier analysis and Dirichlet's theorem; some introductory harmonic analysis (e.g., singular integrals, Littlewood-Paley, multipliers, etc.). The actual topic(s) will depend on the interests of the audience.

**Prerequisites:** Familiarity with measure theory (required) and Hilbert spaces (recommended).

**Texts (optional):**

Typed lecture notes.

Dym and McKean, *Fourier Series and Integrals*, Academic Press.

Stein and Shakarchi, *Fourier Analysis: an Introduction*, Princeton University Press.

**Grades:** Grades will be based on a take-home midterm (15%) and a 3-hour final exam (85%).

**Problem sets:** There will be 6-7 problem sets (roughly weekly). Many of them will be difficult, but they provide an excellent way to test and develop your problem solving skills, as well as the ability of identifying the correct theorems to use.

**Exams:** The midterm will be distributed on Friday, 31st October, and to be handed in on Thursday the following week. It will be at the similar level as homework problems. The final exam will cover the whole range of the course. It will be easier than homeworks.