Fourier Analysis
Second Semester 2009/10
Course Document

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Useful References:

- J. Duoandikoetxea, *Fourier Analysis*, Chapters 1 & 2;
- E.M. Stein & R. Shakarchi, *Fourier Analysis: An Introduction*
- M.A. Pinsky, *Introduction to Fourier Analysis and Wavelets*
- A. Pinkus & S. Zafrany, *Fourier Series and Integral Transforms*
- L. Grafakos, *Classical and Modern Fourier Analysis*;
- W. Schlag, *Harmonic Analysis Notes*, www.math.uchicago.edu/˜schlag/

Course Summary: The aim of this course is to provide an introduction to the main ideas and tools in Fourier Analysis. The course will first and foremost aim to introduce two broad but closely related subjects. First, we will discuss when it is possible to write a periodic function as a trigonometric series (that is, its Fourier series). Secondly, we will also consider the Fourier transform for functions defined on $\mathbf{R}^n$ and useful applications of these ideas. If time permits, we will then go on to consider approximate identities and the Hardy-Littlewood maximal function and their importance as tools in Fourier analysis.

Syllabus: The principal material in this course will be roughly the following.

> Fourier coefficients and series, point-wise and norm convergence of Fourier series, summability methods, the Fourier transform, the Schwartz class and tempered distributions, the Fourier transform on L^p.

If there is time, we will cover perhaps one or two of the following subjects. Exactly what we will cover will become clearer as the semester progresses, so feel free to ask me later for more details.

> Approximations of the identity, weak-type inequalities and almost everywhere convergence, Marcinkiewicz interpolation theorem, the Hardy-Littlewood maximal function, the dyadic maximal function.

Assessment: There will be one examination at the end of the year which will count for 85% the assessment for the course. Homework assignments will account the remaining 15%.

Homework: Problems will be assigned every other week and you will have a week to complete and hand them in. There will be a total of four assignments and each will count equally towards the 15%. You are encouraged to work on problems together but must write up your solutions independently. We will discuss solutions in class the following week. You are also welcome to ask me questions after class or arrange an appointment at some other time.

Academic Misconduct: Zero marks for the course will be assigned if evidence of cheating or academic misconduct is found in any part of your work for it. Please refer to the University guidelines on plagiarism and related matters.

David Rule