Math 147 Syllabus

Textbook: Elias M. Stein and Rami Shakarchi, “Fourier Analysis: an Introduction”, Princeton University Press.

> Al l of the references in the syllabus are to the above book. Some of the topics will be explored in discussion or (especially for the last two lists of topics) in the term projects.

Overview of Fourier analysis, with motivations from physics and other sciences (in particular, connection between Fourier series and heat and wave equations). Brief history of the subject. [Ch. 1]

Preliminaries, complex numbers, trigonometric polynomials, periodic functions.

Fourier series expansions of periodic functions [Ch. 2, Sects. 1-3

Properties of Fourier series; Dirichlet kernel [Ch.2, Sects. 4-5]

Convergence of Fourier series (pointwise, uniform, and in the mean) [Ch. 3]

Convolution, (partial) derivative and Fourier integrals. Basic properties of the Fourier transform [Material gathered from several sections in the book, especially in Chapters 5 and 6 .]

Examples of applications of Fourier series: Selection of topics among the following ones: spectral theory, eigenvalue (Sturm-Liouville) problems; applications to music and physics; applications to number theory and dynamical systems (for example, billiards). Introduction to the discrete wavelet transform. [Ch. 1’ selection of topics from Ch. 4 and Ch. 7].

Examples of Fourier integrals and their applications: Selected topics from: numerical analysis (and computer science (finite and fast Fourier transform); number theory; separation of variables for ordinary and partial differential equations (for example, the heat and wave equations); an introduction to the continuous wavelet transform. [Selection of topics from Ch. 5, Sects. 2-4, Ch. 6, Sects. 3-5, Ch. 8, esp., Sect. 2].