School of Mathematics

Module MA342A — Harmonic Analysis I 2011-12
(JS & SS Mathematics, JS & SS Two-subject Moderatorship)

Lecturer: Dr. Benoit Sehba

Requirements/prerequisites: prerequisite: MA2223 and MA2224

Duration: Micaelmas term, 11 weeks

Number of lectures per week: 3 lectures including tutorials per week

Assessment:

ECTS credits: 5

End-of-year Examination: A 2-hour examination in Trinity term,

Description: Harmonic Analysis is one of the most successful and beautiful areas of mathematics. From its origins in Fourier series, it has expanded in various ways - singular integral operators, complex analysis, group representation theory, operator theory.

Topics:

Fourier Series: Origins. Convergence of Cesaro means. Mean-square convergence.
Pointwise convergence (for smooth classes). Failure of pointwise convergence.
Weyl's equidistribution theorem.
Fourier Transform: Definition, inversion, Plancherel formula.

Textbooks:

- Fourier Analysis, An introduction, by E. M. Stein and R. Shakarchi, Princeton University Press.
- An introduction to harmonic analysis, by Y. Katznelson, Dover.
- Theory of discrete and continuous Fourier analysis by H. J. Weaver (includes the theory of Lebesgue integration)

Learning Outcomes: On sucessful completion of this module, students will be able to:

- compute the Fourier coefficients of a given function;
- compare two functions by comparing their Fourier coefficients;
- recognize and apply good kernels;
- apply Cesaro and Abel summability to Fourier series;
- apply different convergence methods to Fourier series;
- apply Fourier series to some problems in analysis;

- compute the Fourier transform of a (suitable) function, its inverse, understand and apply the Plancherel formula.

October 18, 2011