



## *The Hebrew University of Jerusalem*

### *Syllabus*

## **HARMONIC ANALYSIS - 80908**

*Last update 26-09-2024*

*HU Credits:* 4

*Degree/Cycle:* 2nd degree (Master)

*Responsible Department:* Mathematics

*Academic year:* 0

*Semester:* 1st Semester

*Teaching Languages:* Hebrew

*Campus:* E. Safra

*Course/Module Coordinator:* Prof Alexander Sodin

*Coordinator Email:* [alexander.sodin@mail.huji.ac.il](mailto:alexander.sodin@mail.huji.ac.il)

*Coordinator Office Hours:* Sundays 14:20-15:20 or by appointment

*Teaching Staff:*

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Prof. Alexander Sodin

Course/Module description:

The course will provide an introduction to harmonic analysis on the three simplest groups: circle, the integers, and the real numbers. We shall develop the general theory explaining how and in which sense can a function be approximated by linear combinations of "harmonics", and also provide applications in various parts of mathematics (analysis, partial differential equations, probability theory and number theory).

Course/Module aims:

Learning outcomes - On successful completion of this module, students should be able to:

apply the theory and methods of harmonic analysis.

Attendance requirements(%):

Teaching arrangement and method of instruction: Three hours of lectures, and an hour devoted to the discussion of problems from the homework assignments.

Course/Module Content:

Fourier series:

- convergence and divergence in various senses
- Cesaro summation
- Wiener algebra and Wiener lemma
- Fourier series of measures
- Fourier series and complex analysis.

Applications:

- diagonalisation of operators commuting with shifts
- random walk on the lattice
- heat equation
- polynomial approximation
- the spectral theorem for unitary operators
- equidistribution modulo one

Fourier transformation:

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- construction
  - Poisson formula and applications
  - additional topics

Required Reading:

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Additional Reading Material:

Y. Katznelson, "Introduction to harmonic analysis"

H. Dym and H. McKean, "Fourier Series and Integrals"

H. Montgomery, "Early Fourier Analysis"

Grading Scheme:

Written / Oral / Practical Exam 70 %

Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 30 %

Additional information: