האוניברסיטה העברית בירושלים THE HEBREW UNIVERSITY OF JERUSALEM



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

<u>Teaching Languages:</u> Hebrew

Campus: E. Safra

Course/Module Coordinator: Prof Alexander Sodin

Coordinator Email: alexander.sodin@mail.huji.ac.il

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

Teaching Staff:

### 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:* 

- construction

- Poisson formula and applications
- additional topics

Required Reading:

<u>Additional Reading Material:</u> Y. Katznelson, "Introduction to harmonic analysis"

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

H. Montgomery, "Early Fourier Analysis"

<u>Grading Scheme:</u> Written / Oral / Practical Exam 70 % Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 30 %

Additional information: