

American University of Beirut

Introduction to Ergodic Theory

MATH 307K – Spring 2022

Time and location:

- MWF 11:00am–11:50am (January 21 – April 29)
- Bliss Hall 206
- Time and location of the exercise sessions to be agreed on.

Textbook:

- *An Introduction to Ergodic Theory* by Peter Walters
- Supplementary notes

Suggested additional references:

- *Foundations of Ergodic Theory* by Marcelo Viana and Kjerfve Oliveira
- *Ergodic Theory (with a view towards Number Theory)* by Manfred Einsiedler and Thomas Ward
- *Fundamentals of Measurable Dynamics* by Daniel Rudolph

Note: The electronic versions of the first two books can be accessed via the [university library](#). You may be prompted to login with your AUB account.

Prerequisite:

- Topology (MATH 214) or agreement with the instructor
- Measure Theory (MATH 303) or measure-theoretic probability

Course description: Ergodic theory is the study of “statistical” or “long-term” properties of dynamical systems. It was originated as an attempt by mathematicians to evaluate the so-called *ergodic hypothesis* in Boltzmann’s statistical mechanics (namely, the equality of time and phase averages), but has since developed into a lively branch of mathematics with broader applications in statistical physics, probability theory, information theory, combinatorics and number theory. This course is an introduction to (a selection of) the standard aspects of ergodic theory.

Tentative contents:

- Measure-preserving transformations
- Poincaré’s recurrence theorem
- Mean and pointwise ergodic theorems
- Ergodicity and mixing conditions
- Topological dynamics
- Geometry of set of invariant measures
- Unique ergodicity and minimality
- Entropy
- Shannon–McMillan–Breiman theorem
- Measures of maximal entropy

Format of the course: There will be regular lectures accompanied by less regular exercise sessions. During the exercise sessions, solutions to pre-assigned problems will be presented by randomly selected participants. Towards the end of the semester, each participant will give a presentation or write a final paper.

Instructor:

 Siamak Taati

- Email: st71@aub.edu.lb
- Office: Bliss Hall 312B
- Office hours: Thursdays 13:00–15:00 (tentative; to be agreed upon during the first week)

Assessment:

- 40% Assignments (to be discussed during the exercise sessions)
- 40% Final presentation or paper
- 20% Active participation