ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people.

COURSE INFORMATION

Course Title	Course Code Number	Credit Value
Topics in Pure Mathematics	MATH 610D	3

Time and Room: MWF 11am-12pm. SWNG 410.

PREREQUISITES

Essential prerequisite: Measure Theory at the level of Math 420/507.

Some familiarity with Hilbert spaces will be useful but is not essential (basic concepts will be recalled as needed). For the latter part of the course, some basic familiarity with group theory is required. Some knowledge of probability theory is useful but not required.

CONTACTS

Course Instructor	E-mail	Office Location
Pablo Shmerkin	pshmerkin@math.ubc.ca	MATH 210

OFFICE HOURS

- Office hours are held in person in MATH 210 on each Wednesday in the weeks when homework is due, from 12:40 to 14:20.
- Additional office hours can be arranged by appointment.

SCHEDULE OF TOPICS

The list of topics and corresponding lectures is approximate and may be adjusted as the course progresses.

1. Ergodicity, recurrence, mixing (Lectures 1-13).

- Measure-preserving systems.
- Recurrence.
- Ergodicity.
- The mean and pointwise ergodic theorems.
- Strong and weak mixing.

2. Invariant measures for continuous maps (Lectures 14-18)
   - Existence of invariant measures.
   - Ergodic decomposition for topological dynamical systems.
   - Unique ergodicity.
   - Measure rigidity and equidistribution.

3. Conditional measures, factors and joinings (Lectures 19-26).
   - Conditional expectations and measures.
   - Ergodic theorem and decomposition revisited.
   - Factor maps.
   - Joinings, Kronecker factors, constructing joinings.

4. Actions of locally compact groups (Lectures 27-35).
   - Ergodicity and mixing.
   - Haar measure and regular representations.
   - Amenable groups, mean ergodic theorem.
   - Pointwise ergodic theorem for some classes of groups.

LEARNING MATERIALS

We will follow the book *Ergodic theory with a view towards Number Theory* by Manfred Einsiedler and Thomas Ward (Graduate Texts in Mathematics, Springer, 2011). This book is freely available through the UBC library in electronic format.

Many other sources exist on the topics covered in this course, additional references will be provided as needed/requested.

ASSESSMENTS OF LEARNING

There will be:

1. Six homework assignments to be handed in. These will be posted on Canvas. Homework solutions must be typeset in LaTex. Tentatively, the due dates are: January 16, January 30, February 13, March 6, March 20, April 3.
2. There will be 6 in-class quizzes. These will be 20 minute long at the end of class on Fridays in which homework is not due (tentatively: January 9, January 23, February 6, February 27, March 13, March 27).

The course grade is computed as: Homework: 90%, Quizzes: 10%. Each assignment and quiz will be equally weighted. The lowest quiz score will be dropped.

Policy on late or missed assignments.

- Accommodations for missed or incomplete assignments will be made on a case by case basis. Please contact the instructor as soon as possible if you anticipate missing an assignment
- Each student is allowed to submit one homework assignment up to 72 hours late without penalty.
- Outside of rare emergencies, other late assignments will not be accepted without prior arrangement.
- Missed quizzes can only be accommodated in case of documented medical or family emergencies that force you to miss at least two quizzes (since the lowest score is dropped). In such cases, the weight of the missed quizzes will be redistributed according to the instructor's discretion.

Policy on collaboration and use of external resources (including AI)

- Before any collaboration or use of external resources allowed by the policy, you must spend a reasonable amount of time (at least a few hours) working on the problems on your own. This is essential for your learning.
- You are encouraged to discuss the homework problems with your classmates, but you must write up your solutions independently, and acknowledge any collaboration.
- You are *not allowed* to directly try to lookup solutions or substantial hints to homework problems online or in books, or ask an LLM (such as ChatGPT) to solve them for you.
- You *are allowed* to use online or printed resources to look up definitions, the statements of theorems, and examples, as well as to clarify concepts you are unsure about. You may also use LLMs to help clarify concepts, or to help with LaTex typesetting.
- You must acknowledge any external resources you used in your solutions, including prompts used with LLMs.
- This policy is based on trust. However, any suspected violations will be investigated according to UBC's academic integrity policies.

Extreme weather ("snow day") policy

- In case of in-person class cancellation due to extreme weather, the lecture will: (a) take place on zoom if the cancellation is announced by midnight the previous day; (b) be postponed to the next class day otherwise.
- In case of class cancellation, any quizzes scheduled for that day will be rearranged or cancelled according to instructor's discretion.
- In case of bad weather, the instructor reserves the right to move lectures to zoom even in the absence of a University-wide cancellation.

Syllabus Policies

General UBC and Mathematics Department policies can be found here.

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