

Course Information for PMath 450/650
(Lebesgue Integration and Fourier Analysis)
in Winter Term 2022

Room and time: M W F 11:30 am – 12:20 pm, in PHY 313.

Note, however, that: for some parts of the term the course will be online, when it will run asynchronously.

Instructor: Alexandru Nica, anica@uwaterloo.ca
(Professor, Pure Mathematics Department).

Teaching Assistant: Christopher Lang, cjlang@uwaterloo.ca
(PhD student, Pure Mathematics Department).

Material covered.

This is a course in the theory of functions of a real variable, with elements of Fourier analysis: we discuss the Lebesgue measure on the real line, the Lebesgue integral, the spaces $L^p(\mathbb{R})$, and (with motivation from the space L^2) some basic facts about abstract Hilbert spaces; then we cover some facts about Fourier series for periodic functions – or in other words, we discuss some elements of “harmonic analysis on the circle”.

Lectures.

- Classes in-person: I will attempt to make the sequence of lectures clear and self-contained, so that your in-class notes can be themselves used as primary reference, when you work on the homework assignments or you prepare for the final exam.
- Classes online: There will be regular postings on Learn which will attempt to substitute, to the best extent possible, an in-person class. For most part these will be *lecture files*, written in a conversational style (not too far from how a well structured in-class presentation would go). The posting of lecture files will follow the MWF pattern, but will be asynchronous (not following a specific time-slot). Your job will be to read every such lecture, *work out* some details/exercises of the lecture that were specifically left for you to do, and submit some of your work on Crowdmark, as part of the homework assignments.

References.

The course has no required textbook. For occasional reference, two well-known books on this topic that may be occasionally used are listed below.

- [1] A.M. Bruckner, J.B. Bruckner, B.S. Thompson, *Real Analysis*. Prentice Hall, 1997.
- [2] H.L. Royden, *Real Analysis, 3rd edition*. Prentice-Hall, 1988.

Homework assignments.

There will be weekly homework assignments, posted on the Learn web-site of the course, and usually due on Fridays. The homework will be submitted and graded on Crowdmark. The lowest homework score will be dropped from the grade calculation.

Please be aware that the presentation style and the clarity of your homework solutions is important, and will be factored into the grading of the assignments.

A homework assignment may occasionally include definitions and facts that are related to the questions on the assignment. Please be aware that such definitions and facts are an intrinsic part of the course, and may be tested on the exam.

Office hours.

All the office hours will be held online, on Microsoft Teams, and will be set by appointment. In order to set such an appointment, please send email to anica@uwaterloo.ca or to cjlang@uwaterloo.ca (with one day in advance, if possible), and also indicate in the email some possible time-slots which would be convenient from your side.

Piazza.

We will use the Piazza platform in order to help facilitate student questions during the term. The signup link for this is <https://piazza.com/uwaterloo.ca/winter2022/pmath450650>

Weights for computing the course-grade.

- For PMath 450: $\left\{ \begin{array}{l} \rightarrow \text{Homework assignments: } 35\%. \\ \rightarrow \text{Written online quiz (a timed Crowdmark assignment): } 10\%. \\ \text{This will take place in early February, and will be on} \\ \text{the material covered during the first 4 weeks of class.} \\ \rightarrow \text{Final Exam: } 55\%. \end{array} \right.$
- For PMath 650: $\left\{ \begin{array}{l} \rightarrow \text{Homework assignments: } 35\%. \\ \rightarrow \text{Project (on a topic agreed upon with the instructor): } 20\%. \\ \rightarrow \text{Final Exam: } 45\%. \end{array} \right.$

The final exam will be common for PMath 450 and PMath 650. It is scheduled to take place in person. If that should turn out to not be possible due to Covid restrictions, then online alternatives will be used, according to the guidelines that will be issued by the Math Faculty at that time.

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check <https://uwaterloo.ca/academic-integrity/> for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4,

<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70>

When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about rules for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline,

<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71>

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals,
<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-72>

Note for students with disabilities: AccessAbility Services (AAS), <https://uwaterloo.ca/accessability-services/>, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AAS at the beginning of each academic term.

Intellectual Property: Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. It is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online. See policy 73 – Intellectual property rights (<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policies/policy-73-intellectual-property-rights>)

UW Email Address: If you are corresponding with other members of the university community, it is expected that you use your University of Waterloo account (userid@uwaterloo.ca). See the “Official Student Email Address” link at uwaterloo.ca/email.