PMATH 450/650 – Winter 2021
Lebesgue Integration and Fourier Analysis

Instructor: Blake Madill
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Class Website: Learn/TBA
Office Hour: TBA
(MS Teams)

List of Topics: Lebesgue measure on the line, the Lebesgue integral, monotone and dominated convergence theorems, L^p-spaces: completeness and dense subspaces. Hilbert spaces, orthonormal bases. Fourier analysis on the circle, Dirichlet kernel, Riemann-Lebesgue lemma, Fejer's theorem and convergence of Fourier series.

Evaluations: The final grade will calculated by the following grading scheme:

Assignments (x3)	20%
Quizzes (Best 10 of 12)	30%
Tests (x3)	50%

Note: Graduate students looking to gain credit for PMATH 650 will have a 35% test weighting and a final oral exam worth 15%.

Textbook: You may find the following books useful for reference:

(1) *Real Analysis.* Royden (and Fitzpatrick).
(2) *Harmonic Analysis.* Helson.

However, the course will be self-contained and these texts should be considered highly optional.

Modules: On or before each Monday, the module videos will be posted for the entire week. You will be expected to watch these videos carefully and completely throughout the week.

Assignments: There will be 3 assignments. These dates are subject to change. Late assignments will receive a grade of 0.

Assignments will be submitted through Crowdmark and will be due on the below dates at 9:00 AM ET.

Assignment 1	Wednesday, Feb 3
Assignment 2	Wednesday, March 3
Assignment 3	Wednesday, April 7

Tests: There will be 3 tests. Each test will be the length of a 90 minute test and can be written anywhere within a **24 hour window**. The tests will be submitted through Crowdmark. **Tests must be done independently without external resources. You may, however, use the lecture videos, the course texts, and your own personal notes.**

	Posted	Due by
Test 1	Wednesday, Feb 10 @ 9 AM	Thursday, Feb 11 @ 9 AM
Test 2	Wednesday, March 10 @ 9 AM	Thursday, March 11 @ 9 AM
Test 3	Wednesday, April 14 @ 9 AM	Thursday, April 15 @ 9 AM

Quizzes: The purpose of each quiz is to ensure you have watched and digested the weekly lectures. The quizzes will generally be more conceptual than the assignments. Each quiz will be posted along with the relevant modules. You will have until 11:59 PM (ET) on the following Friday to submit your solutions to Crowdmark. **Quizzes must be done independently without external resources. You may, however, use the lecture videos, the course texts, and your own personal notes.**

Quiz 1	Friday, Jan 15
Quiz 2	Friday, Jan 22
Quiz 3	Friday, Jan 29
Quiz 4	Friday, Feb 5
Quiz 5	Friday, Feb 12
Quiz 6	Friday, Feb 26
Quiz 7	Friday, March 5
Quiz 8	Friday, March 12
Quiz 9	Friday, March 19
Quiz 10	Friday, March 26
Quiz 11	Friday, April 2
Quiz 12	Friday, April 9

Teaching Assistants: The TAs will be in charge of the grading *and regrading* of your assignments. Their contact information is as follows:

- TBA, tba@uwaterloo.ca

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 the Office of 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. 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 an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about rules for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

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.

Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, 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 AccessAbility Services at the beginning of each academic term.

Course Schedule

Week #	Week of	Topics and sections covered	Info
1	Jan 11	Outer Measure	
2	Jan 18	Lebesgue Measure I	
3	Jan 25	Lebesgue Measure II	
4	Feb 1	Measurable Functions	A1
5	Feb 8	Littlewood's Principles	T1
	Feb 15	Reading Week	
6	Feb 22	Integration I	
7	March 1	Integration II	A2
8	March 8	L^p Spaces	T2
9	March 15	Hilbert Spaces	
10	March 22	Fourier Analysis I	
11	March 29	Fourier Analysis II	
12	April 5	Fourier Analysis III	A3
13	April 12	Study Week	T3

Note: This schedule is subject to change at any time.