

PMATH 450/650 – Winter 2020  
Lebesgue Integration and Fourier Analysis

Instructor: Blake Madill	Office hours:	Mon. 1:30 - 2:30, Wed. 11:30 - 12:30, or by appointment
Email: bmadill@uwaterloo.ca		
Office: MC 5423	Class Website:	<a href="https://learn.uwaterloo.ca">https://learn.uwaterloo.ca</a>
Class Time: MWF, 9:30 - 10:20	Location:	MC 4045

**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.

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

Assignments (Best 4 of 5)	20%	
Tests (x2)	40%	(See Schedule)
Final Exam	40%	(to be scheduled by the Registrar's Office)

Note: Graduate students wishing to gain credit for PMATH 650 will have the same assignment and final exam weighting, but 2 tests worth 15% each and an oral exam worth 10%

**Textbook:** You may find the following (optional) books useful for reference:

- (1) *Real Analysis*. Royden (and Fitzpatrick).
- (2) *An Introduction to Harmonic Analysis*. Katznelson.

**Assignments and Tests:** There will be 5 assignments and 2 in-class tests.

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

Assignment 1	Thursday, Jan. 23
Assignment 2	Thursday, Feb. 6
Test 1	Wednesday, Feb. 12
Reading Week	Feb. 17 - 21
Assignment 3	Thursday, Feb. 27
Assignment 4	Thursday, March 12
Test 2	Wednesday, March 18
Assignment 5	Thursday, April 2

These dates are subject to change. Late assignments will receive a grade of 0.

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

- Ragini, r4singha@uwaterloo.ca
- Jacob, j48campb@uwaterloo.ca

**Website:** The course web site is at [learn.uwaterloo.ca](https://learn.uwaterloo.ca) (Waterloo LEARN), where assignments, solutions, grades, a copy of this syllabus, and occasional other information will be posted. Assignments will be submitted through [crowdmark.com](https://crowdmark.com).

**Reading Week:** Feb. 17 - 21.

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. 6	Algebras of Sets, Outer Measure	
2	Jan. 13	Lebesgue Measure I	
3	Jan. 20	Lebesgue Measure II, A non-measurable set	A1 due
4	Jan. 27	Measurable Functions I	
5	Feb. 3	Measurable Functions II, Littlewood's Principles	A2 due
6	Feb. 10	Integration I	Test 1
7	Feb. 17	<i>Reading Week</i>	
8	Feb. 24	Integration II	A3 due
9	March 2	$L^p$ spaces	
10	March 9	Fourier Analysis I	A4 due
11	March 16	Fourier Analysis II	Test 2
12	March 23	Fourier Analysis III	
13	March 30	Fourier Analysis IV	A5 due

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