

**Faculty of Science Course Syllabus** (revised June 2018)**Department of Mathematics & Statistics**

MATH 4010 (cross-listed with Math 5010)

Measure Theory &amp; Integration

Fall 2018/2019

**Instructor(s):** Keith F. TaylorEmail: [Keith.taylor@dal.ca](mailto:Keith.taylor@dal.ca)

Office: 123 Chase

**Lectures:** TR 13:05-14:25

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**Course Description**

Lebesgue's theory of measure and integration. The topics include: sigma-algebras, measures, construction of measures, Lebesgue measure on the real line, measurable functions, the Lebesgue integral and convergence theorems,  $L_p$  spaces, product measures and the Fubini-Tonelli theorem.

**Course Prerequisites**

MATH 3501

**Course Objectives/Learning Outcomes**

The objective of this course is for the student to develop a solid understanding of Lebesgue's theory of integration including the fundamental theorems. At this level, it is expected that the student is adept at creating and writing mathematical arguments, but this course will refine those skills. Specific outcomes for the student are:

- Refined skill in creating clear and correct mathematics.
- Familiarity with theory of measure theory and integration as presented in the course.
- The ability to use concepts from the course to analyse novel problems appropriate to the level of the course.
- A demonstrable overview of how the major theorems presented in the course depend on the web of preliminary results.

**Course Materials**

Textbook: *Measure, Integration & Real Analysis* by Sheldon Axler. An electronic copy is provided to all students at no cost.

**Course Assessment**

Assessment is based on regular assignments, a term test and a final exam.

Assignments are due weekly, Tuesdays, 1:05PM.

Value = 20% of final grade

Term test: November 1, 1:05-2:25.

Value = 20% of final grade

Final exam scheduled later.

Value = 60% of final grade

**Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale**

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

**Course Policies**

The best 10 of your assignments will be used in computing the assignment portion of your grade. Late assignments will not be used in selecting those best 10. Make-up tests or exams will be provided based on a valid medical or compassionate reason.

**Course Content**

Lecture topics (some of these topics will require more than one lecture):

- Outer measure on  $\mathbf{R}$ .
- Measurable spaces and functions.
- Measures and their properties.
- Lebesgue measure.
- Functions on measure spaces.
- Integration with respect to a measure.
- Limits of integrals and integrals of limits.
- Products of measure spaces.
- Iterated integrals.
- The Lebesgue integral in  $n$  dimensions.
- $L_p$ -spaces, completeness and duality.
- Hilbert spaces.
- A sample of Fourier analysis.
- Radon-Nikodym theorem.

**University Policies and Statements**

**This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate**

**Academic Integrity**

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

**Information:** [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

**Accessibility**

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

**Information:** [https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)

**Student Code of Conduct**

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

**Code:** [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

**Diversity and Inclusion – Culture of Respect**

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

**Statement:** <http://www.dal.ca/cultureofrespect.html>

**Recognition of Mi'kmaq Territory**

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support.

Visit or e-mail the Indigenous Student Centre (1321 Edward St) ([elders@dal.ca](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Important Dates in the Academic Year (including add/drop dates)**

[https://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html)

**University Grading Practices**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

**Missed or Late Academic Requirements due to Student Absence (policy)**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html](https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html)

**Student Resources and Support****Advising**

**General Advising** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

**Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

**Academic supports**

**Library:** <https://libraries.dal.ca/>

**Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

**Studying for Success:** [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

**Copyright Office:** <https://libraries.dal.ca/services/copyright-office.html>

**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

**Other supports and services**

**Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness/services-support/student-health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)

**Student Advocacy:** <https://dsu.ca/dsas>

**Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

**Safety**

**Biosafety:** <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

**Chemical Safety:** <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

**Radiation Safety:** <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

**Scent-Free Program:** <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>