

Pure Math 451/651, Winter 2019

COURSE OUTLINE

Lecturer Information

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Grade Distribution

	Pure Math 451		Pure Math 651
Homework assignments	= 50 %	Homework assignments	= 45 %
Final exam	= 50 %	Talk	= 15 %
		Final exam	= 40 %

Homework assignments will be given on a fortnightly basis.

Syllabus

Measures

- σ -algebras
- measures
- pre-measures, outer measures and Caratheodory's Theorem.
- Borel measures on \mathbb{R} , Lebesgue-Steiltjes measures

Integration

- measurable functions
- integrals of non-negative functions, Monotone Convergence Theorem and Fatou's Lemma
- integration of complex-valued functions, Dominated Convergence Theorem
- modes of convergence, Egoroff's Theorem
- Product measures, Tonelli's Theorem, Fubini's Theorem
- n -dimensional Lebesgue integral

Signed measures and differentiation

- signed measures, Hahn and Jordan decompositions, total variation
- Lebesgue-Radon-Nikodym Theorem and Lebesgue decomposition
- complex measures
- Differentiation on \mathbb{R}^n , maximal functions, Lebesgue Differentiation Theorem
- functions of bounded variation on \mathbb{R} , absolute continuity

L^p -spaces

- basic theory, Holder and Minkowski inequalities
- dual spaces
- inequalities, containment relations

Radon measures

- positive linear functionals on $C_c(X)$, Riesz Representation Theorem
- regularity and approximation, Lusin's Theorem
- dual of $C_0(X)$

Texts

Real Analysis: Modern techniques and Their Applications, Gerald B. Folland, Wiley-Interscience, 1999 (second edition)

Supplementary:

Measure Theory, D.L. Cohn, Birkhäuser/Springer, 2013. [SpringerLink](#), online through the library website.

Measure Theory, V.I. Bogachev, Springer, 2007.

Real Analysis, H.L. Royden, Prentice-Hall, multiple editions

Real Analysis, A.M. Bruckner, J.B. Bruckner and B.S. Thomson, Prentice Hall, 1997.

classicalrealanalysis.info/Free-Downloads.php

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 www.uwaterloo.ca/academicintegrity/ 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,

<http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>.

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,

<http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>.

For typical penalties check Guidelines for the Assessment of Penalties,

<http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm>.

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, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>.

Note for students with disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, 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 the OPD at the beginning of each academic term.