

Math 616, Real Analysis I, Fall 2018

Class Time: MWF 11-1:50a.m. in 210 Deady Hall
Instructor: Dr. Marcin Bownik
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Office Hours: M 12–1p.m., W 1-2p.m., and F 10-11a.m., or by appointment

- 1. Background and goals.** This course introduces students to the subject of real analysis, and to a lesser extent: functional analysis, harmonic analysis, and complex analysis. Topics include: outer measures, Lebesgue measure, measurability, integration, L^p -spaces, signed and and complex measures, Lebesgue-Radon-Nikodym Theorem, product measures and Fubini's Theorem. The course, which is the first of three in the sequence, covers most of the chapters 1–5 of Cohn's textbook.
- 2. Learning Outcomes.** Students should be able to solve problems by providing clear and logical proofs involving the following concepts:
 - σ -algebras, outer measures, Lebesgue measure, and Borel regularity,
 - simple functions, measurable functions, Lebesgue integral, Fatou's Lemma, Lebesgue Monotone and Dominated Convergence Theorems, and Egorov's Theorem,
 - Hölder's inequality, Minkowski's inequality, L^p spaces of measurable functions and their approximation by continuous functions,
 - signed and complex measures, absolute continuity and singularity of measures, Lebesgue-Radon-Nikodym Theorem, and Hahn Decomposition Theorem,
 - product measures and Fubini's Theorem.Students should be able to give examples and counterexamples illustrating connections between the above concepts and to critically analyze all steps of a mathematical argument for correctness and clarity. In particular, self-check one's own work to find insufficiently explained steps.
- 3. Exams.** There will be one midterm in-class exam on Wed. 10/31, and a final exam on Th. 12/6, 10:15a.m.–12:15p.m.
- 4. Homework.** Homework problems will be assigned every week and be due in class on Wednesday on the material of the previous 1–2 weeks. No late homework will be accepted. Group work on homework is encouraged, but each student must individually write and turn in her/his own assignment.

Homework	40%
Midterm Exam	20%
Final Exam	40%
- 5. Grading.** The grading distribution will be as follows:
- 6. Primary Textbook.** *Real and Complex Analysis*, W. Rudin, 3rd ed., McGraw-Hill.
- 7. Secondary Textbooks.** *Measure Theory*, D. Cohn, 2nd ed., Birkhäuser,
Real Analysis, G. Folland, 2nd ed., John Wiley & Sons.