Math 617, Real Analysis II, Winter 2019

Class Time:	MWF 11-12:50a.m. in 210 Deady Hall
Instructor:	Dr. Marcin Bownik
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Office:	323 Fenton
Office Phone:	346-5622
Office Hours:	1-2pm Mon., 1-2pm Wed., and 12-1pm Fri., or by appointment
Textbook:	*Real and Complex Analysis*, W. Rudin, 3rd ed.

1. **Background and Goals.** This course introduces students to the subject of real analysis, and to a lesser extent, complex and functional analysis. Topics include: the Riesz Representation Theorem, Hilbert spaces, Banach spaces, dual spaces, Lebesgue points of differentiability, the Fundamental Theorem of Calculus, the change of variables theorem, convolutions, and the Hardy-Littlewood maximal function. The course, which is the second of three in the sequence, covers most of the chapters 2 and 4–8 of Rudin's textbook.
2. **Learning Outcomes.** Students should be able to solve problems by providing clear and logical proofs involving the following concepts:
   • the Riesz Representation Theorem for positive functionals on $C_c(X)$, the construction of the Lebesgue measure through the Riemann integral, the Lusin Theorem, and the Vitali-Carathéodory Theorem,
   • Hilbert spaces, orthonormal sequences, orthonormal projections, Fourier series of L^2 functions,
   • Banach spaces, the Banach-Steinhaus Theorem, the Open Mapping Theorem, the Hahn-Banach Theorem, Fourier series of continuous functions, summability kernels,
   • Dual spaces, duality of L^p spaces, duality of $C_0(X)$ spaces, weak topologies, and Alaoglu's Theorem,
   • Lebesgue points of differentiability, absolutely continuous functions, the Fundamental Theorem of Calculus, the change of variables theorem,
   • convolutions, distribution functions, the Hardy-Littlewood maximal function, and the Marcinkiewicz Interpolation 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. 2/13, and a final exam on Mon. 3/18, 10:15a.m.–12:15p.m.
4. **Homework.** Homework problems will be assigned every week and be due 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.
5. **Grading.** The grading distribution will be as follows:

Homework:	40%
Midterm Exam:	20%
Final Exam:	40%