Syllabus

Title	Real Analysis I
Number	MATH 5305-261
Time	MW 5:30–6:45
Place	BH 224
Instructor	David Milovich
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Phone	(956) 326-2570
Office	BVC 321
Hours	MTWR 11:00–11:45, 1:45–2:30
Department	Engineering, Mathematics, and Physics
College	Arts and Sciences
Institution	Texas A&M International University
Term	Spring 2013

Course description. This is a course on Lebesgue measure and integration. The classical L^p spaces will be defined and basic results established, such as the Holder and Minkowski inequalities and completeness of the spaces. Prerequisites: Graduate standing and permission of instructor.

Student learning outcomes. Upon successful completion of this course, the student will be able to:

- explain the concepts of measurable sets, measurable function and measure;
- define the concept of Lebesgue Measure and Lebesgue Integral;
- explain the difference between the Lebesgue Integral and the Riemann Integral;
- distinguish between uniform convergence and pointwise convergence, and apply the Lebesgue dominated convergence theorem to prove convergence of integrals and the continuity of basic integral transforms, such as the Fourier Transform;
- explain the definition of Lp spaces, the Riesz representation theorem, and the completeness of the Lp spaces;
- explain the definition of the derivative of a measurable function; and
- explain how to construct measure theory in spaces other than the real line.

Textbook. Required: *Real & Complex Analysis* (1987). 3rd edition. Walter Rudin. McGraw-Hill. ISBN: 0-07-054234-1.

Homework. Homework is worth 40% of your grade and will be roughly weekly. This grade is based on completeness, not correctness, though I will comment where I see problems.

Tests. The two take-home tests (see the schedule below) are each worth 20% of your grade; the take-home final exam is also worth 20% of your grade. The final will be comprehensive, though emphasizing topics covered after the second test. Tests are open-book and open-note, but must be your own work. That is, you may consult written, printed, and electronic resources, but you may not ask another person, either directly or indirectly (such as through an internet forum) questions for your test.

Grading.

As this is a graduate course, I will give A's for very good work, B's for satisfactory work, and C's or worse for unsatisfactory work.

Approximate Schedule of Topics

Date	Chapter	Book section	Notes
23-Jan		Introduction	
28-Jan	1	Set-theoretic notation and terminology	
30-Jan	1	The concept of measurability	
4-Feb	1	Simple functions; Arithmetic in $[0, \infty]$	
6-Feb	1	Elementary properties of measures	
11-Feb	1	Integration of positive functions	
13-Feb	1	Integration of complex functions	
18-Feb	1	The role played by sets of measure zero	
20-Feb	2	Vector spaces	
25-Feb	2	Topological preliminaries	
27-Feb	2	The Riesz representation theorem	Test I assigned
4-Mar	2	Regularity properties of Borel measures	Test I due
6-Mar	2	Lebesgue measure	
18-Mar	2	Continuity properties of measurable functions	
20-Mar	3	Convex functions and inequalities; the L^p-spaces	
25-Mar	3	Approximation by continuous functions	
27-Mar	6	Total variation	
1-Apr	6	Absolute continuity; consequences of Radon-Nikodym Theorem	
3-Apr	6	Bounded linear functionals on L^p; Riesz representation theorem	
8-Apr	7	Derivatives of measures	
10-Apr	7	The fundamental theorem of Calculus	
15-Apr	8	Measurability on cartesian products	
17-Apr	8	Product measures	Test II assigned
22-Apr	8	The Fubini theorem	Test II due
24-Apr	8,9	Convolutions; formal properties of Fourier transfrom	
29-Apr	9	The inversion theorem	
1-May	9	The Plancherel theorem	
6-May		Review	