

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): MATH 2130 Real Analysis (3,3,0)

Course Aims: This course provides an introduction to measure theory, Lebesgue integration, L^p spaces, and Fourier analysis. Equipped with this knowledge, students are prepared for further studies in numerical analysis, functional analysis and advanced probability theory.

Prerequisite: MATH 1111 Mathematical Analysis I

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Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand the idea of set theory and measure theory
2	Able to realize the higher level concept of integrability of functions
3	Able to know the definition and properties of L^p spaces
4	Able to know orthonormal bases, Bessel's and Parseval's equalities, and their uses in obtaining the theories of Fourier series
	Skills
5	Able to construct appropriate approximations of functions and apply them to practical problems
6	Able to apply convergence tests for sequences and series
	Attitudes
7	Able to appreciate the classical results of Real Analysis and their applications

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments and test)	30%	Continuous assessments are designed to measure how well the students have learned the basic concepts and fundamental theory of real analysis and their applications.
2	Final Examination	70%	Final Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be understanding and skills based to assess the student's versatility in real analysis.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Sets and Measures	1	13
II. Integration	2, 7	10
III. L^p Spaces	3,	5
IV. Fourier Series	4, 5, 6, 7	12

Textbook: H.L. Royden, Real Analysis, 3rd edition, Collier MacMillan, 1988.

References: W. Rudin, Real and Complex Analysis, 3rd edition, TATA McGraw-Hill, 1986.
H. Dym and H.P. McKean, Fourier Series and Integrals, Academic Press, 1972.
J.L. Doob, Measure Theory, Springer Verlag, 1994.
M. Cartwright, Fourier Methods, Ellis Horwood, 1990.
G.A. Edgar, Measure, Topology and Fractal Geometry, Springer Verlag, 1990.
復旦大學，數學分析, 1972.

Course Content in Outline:

	<u>Topic</u>	<u>Hours</u>
I.	Sets and Measures	13
	A. Algebra of sets	
	B. Topology and Borel sets	
	C. Measures and outer measures	
	D. Measurable sets and measurable functions	
	E. Lebesgue measure	
II.	Integration	10
	A. Definition of integration	
	B. Riemann integral and Lebesgue integrals	
	C. Convergence theorems	
III.	L^p Spaces	5
	A. Definition and properties of L^p spaces	
	B. L^1 and L^2 spaces	
IV.	Fourier Series	12
	A. $L^p(-\pi, \pi)$ and P^2	
	B. Orthonormal bases, Bessel's inequality and Parseval's equality	
	C. Fejer's theorem and applications	
	D. L^1 theory of Fourier series	
	E. Riemann - Lebesgue lemma	
	F. Test of convergence	
	G. Examples and applications	