Program	Level	First cycle / Second cycle		
	Name of the program	Pure Mathematics, Mathematics Education		
COURSE				
Course title	**Measure Theory and Integration**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
PMAT 380	VI / II	Mandatory course	5	3+2+0
Lecturer				
Course Goals	Within this course, students will get acquainted with basic concepts of modern mathematical analysis which will improve the knowledge acquired within the courses such as Analysis I, Analysis II and Analysis III. Completion of this course will enable students to understand probability theory and its applications in statistics, as well as to successfully follow other more advanced courses in analysis, analytical number theory, and applied mathematics.			
Learning Outcomes	Upon successful completion of the module, students will be able to: - understand the concept of Borel and Lebesgue-Stieltjes measures on the real line - apply the simple function approximation theorem - observe and apply the advantages of the Lebesgue integral on the real line over the Riemann integral, such as the exchange of limit and integral, the termwise integration of the series of functions and the differentiation under the integral sign - understand the concept of product measure and use the Fubini-Tonelli theorem when examining the integrability of a function on the product space - observe the connection between functions of bounded variation on the real line and signed measures - calculate the Lebesgue-Stieltjes integrals of functions and apply the advantages of that integral over the Riemann-Stieltjes integral - apply the Lebesgue-Radon-Nikodym theorem on the decomposition of a signed measure - apply the acquired knowledge to more complex problems of real analysis			

COURSE CONTENT

- The notion of measure. Outer measure and Caratheodory's theorem.
- Pre-measure and the method of construction of the measure.
- Measure on the real line. Borel measures.
- Lebesgue-Stieltjes measure.
- Measurable functions. Approximation theorem.
- Lebesgue integral.
- Lebesgue Dominated Convergence Theorem and its consequences.
- Comparison between Lebesgue and Riemann integration.
- Product measures. Fubini-Tonelli theorem and its applications.
- Modes of convergence.
- Lp spaces and their properties.
- Signed measures. Hahn Decomposition Theorem.
- Singular and absolutely continuous measures.
- Lebesgue-Radon-Nykodim theorem.
- Integration with respect to a signed measure.

LITERATURE

[1] H. Royden, Real Analysis, 3rd ed. Macmillan Publishing Company, New York

[2] E. M. Stein, R. Shakarchi, Real Analysis : Measure Theory, Integration, and Hilbert Spaces, Princeton University Press, 2005

STUDENT WORKLOAD (hours in a semester)

Lectures	45	Exercises	30	Individual work	50	T o t a l	125

GRADING			REMARKS
Criterion	Maximum points	Minimum points	
Midterm exams	50	25	
Final exam	50	30	
T o t a l	100	55	