

M127	<b>Measure and Integral</b>	L	P	S	ECTS
		3	2	0	7

**Course objectives.** Students should be introduced to fundamental ideas and methods of measure theory, which represent the basis for many other courses.

**Prerequisites.** Undergraduate study programme in mathematics, computer science and similar study programmes.

**Course content.**

1. Introduction. Countable sets and basic topological terms.
2. Measure. Problem of measure.  $\sigma$ -algebra. A measure on  $\sigma$ -algebra. External measure. Measurable sets. Carathéodory's Theorem. Lebesgue external measure. Lebesgue measure. Cantor's set. Lebesgue-Stieltjes measure. Space of full measure.
3. Integral. Measurable functions. Simple functions. Property "almost everywhere". Integral of non-negative simple functions. Integral of non-negative measurable functions. Levi's theorem on monotonic convergence. Fatou's lemma. Integral of measurable function. Lebesgue's theorem on dominance convergence. Relationship between Riemann and Lebesgue integrals.

**LEARNING OUTCOMES**

No.	LEARNING OUTCOMES
1.	Explain basic concepts in abstract theory of measure and integration.
2.	To present and prove basic theorems in the theory of measure and integration.
3.	Describe the concept and properties of measurable functions.
4.	Explain the construction of integrals.
5.	Apply convergence theorems on solving specific problems
6.	Explain the connection between Riemann's and Lebesgue's integrals.
7.	To apply the acquired knowledge in the theory of measure and integration in other courses.

**RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ASSESSMENT OF THE LEARNING OUTCOMES**

TEACHING ACTIVITY	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	POINTS	
					min	max
Attending lectures and exercises	1	1-7	Lecture attendance, discussion, team work and independent work on given tasks	Attendance lists, tracking activities	0	4
Written exam (Mid-terms)	2	1-7	Preparing for written exam	Evaluation	25	48
Final exam	4	1-7	Revision	Oral exam	25	48
TOTAL	7				50	100

**Teaching methods and student assessment.** Lectures and exercises are obligatory. The exam consists of a written and an oral part. Upon completion of the course, students can take the exam. Successful midterm exam scores replace the written exam.

**Can the course be taught in English:** Yes

**Basic literature:**

1. D. Jukić, *Mjera i integral*, Odjel za matematiku, Osijek, 2012.
2. D. L. Cohn, *Measure theory*, Birkhäuser, 1980.

**Recommended literature:**

1. S. Mardešić, *Matematička analiza 2: Integral i mjera*, Školska knjiga, 1977
2. W. Rudin, *Principles of Mathematical Analysis*, Mc Graw-Hill, Book Company, 1964.
3. R. L. Schilling, *Measures, integrals and martingales*, Cambridge University Press, New York, 2005.
4. H. J. Wilcox, D. L. Myers, *An Introduction to Lebesgue Integration and Fourier Series*, Dover, New York, 1994.

