Subject code	ECTS credits
MAT3006	6

Course title in Lithuanian

MATO IR INTEGRALO TEORIJA

Course title in English

MEASURE AND INTEGRAL THEORY

Short course annotation in Lithuanian (up to 500 characters)

Studentas bus susipažinęs su analiziniais matematikos metodais, kurie pagilina ir praplečia realaus kintamojo funkcijų teorijos žinias. Kursas apima aibių teoriją (sekos, galia, realiųjų skaičių topologija ir funkcijų tolydumas); mato teoriją (sigma-algebros, matai, mačiosios aibės, veiksmai su matais); integralo teoriją (mačius atvaizdžius, mačias funkcijas, tam tikrų funckcijų integravimą); konvergavimo rezultatus (konvergavimo tipus, ryšius tarp skirtingų konvergavimų); Lebego matą Rn erdvėje.

Short course annotation in English (up to 500 characters)

Students are introduced to analytic techniques of mathematics, deepening and extending the knowledge of real variable functions theory. Course covers sets theory (sequences, including cardinality, real numbers topology and continuity of functions); measure theory (sigma-algebras, measures, measurable spaces, operations on measures); integration theory (measurable mappings, measurable functions, integrating certain functions); convergences results (types of convergence; relations between different types of convergence); Lebesgue measure on space Rn.

Prerequisites for entering the course

Mathematical Analysis, Algebra, Geometry

Course aim

Main aim of the course is to introduce elements of abstract measure and integral theory and to extend the knowledge of real variable functions theory.

Links between course outcomes, criteria of learning achievement evaluation, study methods and methods of learning achievement assessment

No	Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1.	Understanding meaning and recognizing relations between main terms of sets, measure and integral theory.	Student demonstrates knowledge and ability to formulate and illustrate with examples and counterexamples the measureable sets and functions, measurable mappings, Lebesgue integral, types of convergence.	Lecture, practical exercises (tasks), literature analysis, individual work, tutorials	Test, Midterm
2.	Perceive and prove main statements of measure and integral theory.	Student demonstrates knowledge and ability to formulate and prove well-known propositions.	Lecture, practical exercises (tasks), literature analysis, individual work, tutorials	Midterm, Exam
3.	Identification and solution of a problem, using functional relations between objects of mathematical analysis, algebra, geometry and so	Student analyses the initial information, recognizes well known mathematical situations and performs the ability to apply them for the calculus of cardinality, Lebesgue integral	Lecture, practical exercises (tasks), individual work, tutorials	Test, Exam

	one, as well applying various methods.	(sometimes with simple modified conditions).		

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome		
	1	2	3
Know and comprehend concepts and propositions of fundamental mathematical subjects, recognize and apply them solving practical/theoretical tasks	+		+
Summarize and evaluate critically scientific and professional literature, as well as use various tools for collecting of information for the study process and for solving fixed practical/theoretical problems		+	+
Operating with formal mathematical symbols and terms, determine mathematical connections between various mathematical quantities; conceive mathematical propositions and logical proofs, construct and prove new statements	+	+	+
Think logically and analytically, evaluate alternative ways of task solving and implement optimal solutions	+		+

Content

No	Content (topics)
1.	Basic operations on sets. Mapping of sets. Cardinality. Systems of sets.
2.	Continuous functions. Step functions. Monotone functions. Absolutely continuous functions.
3.	Indefinite and definite integrals.
4.	Riemann and Stieltjes integrals.
5.	Some properties of step functions integrals.
6.	Lebesgue integral.
7.	Applications of multiple integrals.
8.	Classes of sets.
9.	Spaces with measure.
10.	Continuation of measure.
11.	Lebesgue-Stieltjes measures on line. Distribution functions.
12.	Measurable mappings and real measurable functions.
13.	Convergence almost everywhere and convergence by measure.
14.	Integral of the function.
15.	The Lp spaces.

Distribution of workload for students (contact and independent work hours)

Lectures	**45 hours**
Practical work	**30 hours**
Individual students work	**85 hours**
Total:	**160 hours**

Structure of cumulative score and value of its constituent parts

Mid-term exam (25 %), Assessment of practical work (25 %: two tests, each by 12.5 %), Final exam (50%).

Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	*Self-study rooms*	*Other libraries*
Basic materials						
1.	1998	V. Mackevičius. Integralas ir matas	Vilnius: TEV	13	1	
2.	2011	T. Tao. An Introduction to Measure Theory	Providence RI: AMS	Available online https://terrytao.wordpress.com/books/an-introduction-to-measure-theory/		

3.	1992	E.T. Copson, Metric spaces	Cambridge: Cambridge University Press	2		
4.	2006	M.E. Taylor. Measure Theory and Integration	Providence RI: AMS		1	
			Supplementary materials			
1.	1970	J. Kubilius. Realaus kintamojo funkcijų teorija	Vilnius: Mintis			
2.	2002	I.K. Rana. An Introduction to Measure and Integration (AMS, Vol. 45)	Narosa Publ. House			
3.	1996	P. Alekna. Aibės, jų galia ir struktūra	Šiauliai: ŠPI			

Course programme designed by

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