Subject code	ECTS credits
MAT3007	6

Course title in Lithuanian

MATEMATINĖ LOGIKA

Course title in English

MATHEMATICAL LOGIC

Short course annotation in Lithuanian (up to 500 characters)

Įgyjamos esminės matematinės logikos žinios, susipažįstama su algoritmų, formulių teisingumui tikrinti, sudarymu, rezoliucijų principu teiginių logikai, predikatų logikos formulių interpretacija, kanoniniu formulių pavidalu, disjunktų aibėmis, semantiniais medžiais, Herbrand'o teorema, keitinių ir unifikacijos apibrėžimais, rezoliucijų metodu predikatų logikai, paieškos medžiais, paieškos erdvė ir paieškos strategijomis, loginėmis programomis, loginių programų procedūrine semantika, „neigimas – neigiama informacija ir nesėkmė", uždaro pasaulio prielaida, neigimu kaip nesėkmės taisykle, SLDNF - rezoliucija, uždaro pasaulio duomenų bazėmis.

Short course annotation in English (up to 500 characters)

Acquired fundamental knowledge of basic concepts of mathematical logic: validity of formulas, the resolution principle for the prepositional logic, interpretations of formulas in the predicate logic, pre-nex normal forms, a set of clauses, semantic trees, Herbrand's theorem, substitution and unification, the resolution principle for the predicate logic, search trees, space and heuristics, logic programs, declarative semantics of logic programs, procedural semantics of logic programs, negation - negative information and failure, closed world assumption, negation as failure rule, SLDNF - resolution, Closed world databases.

Prerequisites for entering the course

Mathematical Analysis.

Course aim

Course aim is to provide knowledge of basic concepts of mathematical logic, design of algorithms for the investigation of the validity of formulas and development of logic programs of inference in the first-order logic.

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.	Knowledge and understanding of basic concepts and operations in mathematical logic.	Student demonstrates knowledge and understanding by solving problem orientated exercises.	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works.
2.	Ability to formalize meaning of texts by means of propositional and predicate logic. Check and prove correctness of reasoning	Student demonstrates the ability formalize meaning of texts using symbols of set algebra, propositional and predicate logic.	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works.
3.	Ability to perform procedures of logical inference by means of propositional and predicate logic.	Apply resolution algorithm when solving problems of logical inference.	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works.
4.	Construct Knowledge Bases for representation of applied information by means of propositional and	Student demonstrates the ability to construct Knowledge Bases by means of logical methods of knowledge representation.	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works.

	first order logic.			
5.	Ability to design algorithms for the investigation of the validity of formulas and performance of logical inference	Student demonstrates the ability to design algorithms for the investigation of the validity of formulas and resolution rule.	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works.
6.	Ability to develop logic programs of inference in the first-order logic.	Student demonstrates the ability to develop logic programs of inference in the first-order logic.	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works.

Links between study programme outcomes and course outcomes

Study programme outcomes	**Running number of course outcome**					
	1	**2**	**3**	**4**	**5**	**6**
Know and comprehend concepts and propositions of fundamental mathematical subjects, recognize and apply them solving practical/theoretical tasks	+	+	+	+	+	
Identify the problem, collect and analyze real/theoretical data using various mathematical methods, tools and IT technologies	+	+	+	+	+	
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	+	+	+	+	+	+
Critically analyze and evaluate obtained results, take responsibility from the mathematical point of view	+	+		+		

Content

No	**Content (topics)**
1.	Validity of formulas
2.	Resolution principle for the prepositional logic
3.	Interpretations of formulas in the predicate logic
4.	Prenex normal forms
5.	A set of clauses
6.	Semantic trees
7.	Herbrand’s theorem
8.	Substitution and unification
9.	Resolution principle for the predicate logic
10.	Search trees
11.	Space and heuristics
12.	Logic programs
13.	Declarative semantics of logic programs
14.	Procedural semantics of logic programs
15.	Negation - negative information and failure
16.	Closed world assumption
17.	Negation as failure rule
18.	SLDNF - resolution
19.	Closed world databases

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

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

Structure of cumulative score and value of its constituent parts

Final assessment sums the assessments of written final examination (50%), written mid-term examination (25%) and assessment of practical works (25%).

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.	2002	Jusas V. Matematinė logika: Mokomoji knyga (Mathematical Logic)	Kaunas: Technologija	2		
2.	2007	S. Norgėla. Logika ir dirbtinis intelektas (Logic and Artificial Intelligence)	Vilnius: TEV	2		
3.	2004	S. Norgėla. Matematinė logika. (Mathematical Logic)	Vilnius: TEV	2		
4.	2003	S. Russell, P. Norvig. Artificiale Intelligence. A Modern Approach	Prentice Hall	1		
Supplementary materials						
1.	2010	Wei Li. Mathematical Logic: Foundations for Information Science	Birkhäuser (Google books)			
2.	1995	Listopadskis N., Markauskas R.V. Matematinė logika. I, II dalys. (Mathematical Logic I, II)	Kaunas: Technologija			
3.	1990	Apt K.W. Logic Programming in Handbook of Theoretical Computer Science, vol. B.	Nort Holand			
4.	1984	Lloyd J.W. Foundations of Logic Programming	Berlin, Springer-Verlag			
5.	1999	R. Lassaigne, M.de Rougemont. Logika ir algoritmų sudėtingumas. (Logic and the Complexity of Algorithms)	Vilnius: Žara			

Course programme designed by

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