Subject code	ECTS credits
MAT2007	6

Course title in Lithuanian

SKAIČIŲ TEORIJA

Course title in English

NUMBER THEORY

Short course annotation in Lithuanian (up to 500 characters)

Įgyjamos klasikinės skaičių teorijos žinios bei formuojami jų taikymo įgūdžiai. Studentas tai padarys studijuojamas sveikųjų skaičių dalumo teoriją (skaičiavimo sistemos, bendrasis didžiausiasis daliklis ir bendrasis mažiausiasis kartotinis, pirminiai skaičiai, aritmetinės funkcijos, grandininės trupmenos) ir lyginių teoriją (Oilerio funkcija, likinių sistemos, Oilerio ir Ferma teoremos, lyginiai su nežinomaisiais, laipsniniai likiniai).

Short course annotation in English (up to 500 characters)

Acquire knowledge of classical number theory, and form the skills of them application. Students will study the theory of numbers divisibility (numerical systems, greatest common divisor, least common multiple, prime numbers, arithmetical functions, continued fractions) and the congruence theory (Euler totient function, residue systems, Euler and Fermat theorems, congruence with unknowns, power residues systems).

Prerequisites for entering the course

High school mathematics knowledge.

Course aim

Main aim of the course is to provide the students with theoretical and practical knowledge and skills of classical number 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.	Knowledge and understanding of main concepts of classical number theory.	Student demonstrates the ability to illustrate main concepts with examples.	Lecture, exercise classes, individual work, literature analysis, tutorials	Midterm, Test
2.	Provide knowledge to choose appropriate method for solution of practical task.	Student recognizes the type of congruences and solves them choosing the optimal method (GCD, continued fractions, etc.).	Lecture, exercise classes, individual work, practical exercises (tasks), tutorials	Exam, Test
3.	Knowledge and ability to identify one-to-one connections between arithmetical functions.	Understanding main point of task, student recognizes certain arithmetical function (-s) and applies them to solve practical exercise.	Lecture, individual work, literature analysis, practical exercises (tasks), tutorials	Test
4.	Perform the ability to formulate and prove the propositions of classical number theory.	Operating on basic terms and propositions, student proves statements on divisibility of numbers, cases for solution of congruences and etc.	Lecture, exercise classes, individual work, literature analysis, tutorials	Test, Midterm, Exam

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome			
	1	2	3	4

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		+		+

Content

No	Content (topics)
1.	Divisibility of integer numbers. 1.1. Main terms and theorems. Properties of divisibility. 1.2. Numerical systems. 1.3. Greatest common divisor. 1.4. Least common multiple. 1.5. Prime and composite numbers. Coprime numbers. 1.6. Factorization into primes. 1.7. Continued fractions.
2.	Main functions in number theory. 2.1. Integer and fractional part of number. 2.2. Arithmetical and multiplicative functions. 2.3. Number and sum of divisors. 2.4. Möbius function. 2.5. Euler totient function.
3.	Congruences. 3.1. Definition and properties of congruence. 3.2. Modular arithmetic. 3.3. Residue. Ring of residues. 3.4. Systems of residues. 3.5. Euler and Fermat theorems.
4.	One variable congruences. 4.1. Main terms. 4.2. Linear congruences. 4.3. Solution of algebraic congruences. 4.4. Systems of linear congruences. 4.5. Congruences with prime power modulus. 4.6. Congruences with composite modulus. 4.7. Diophantine equations.
5.	Higher order residues. 5.1. Index. 5.2. Primitive roots. 5.3. System fractions. 5.4. Length of period.
6.	Application of number theory in other sciences.

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 %), Evaluation of practical work (25 %: two tests 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.	1990	K. Bulota, P. Survila. Algebra ir skaičių teorija 2.	Vilnius: Mokslas	11	2	
2.	1995	R. Skrabutėnas, P. Survila. Algebros ir skaičių teorijos uždavinynas.	Vilnius: Mokslo ir enciklope-dijų leidykla	3	2	
3.	2004	Kenneth H. Rosen. Elementary Number Theory: and Its Applications.	Addison-Wesley		1	
Supplementary materials						
1.	2001	J.K. Strayer. Elementary Number Theory	Waveland Pr Inc.			
2.	2006	W.A. Coppel. Number Theory: An Introduction to Mathematics	Springer Verlag			
3.	2012	Ab. Kumar. Theory of Numbers		https://ocw.mit.edu/courses/mathematics/18-781-theory-of-numbers-spring-2012/lecture-notes/		
4.	2019	P.J. Cameron. A Course on Number Theory		http://www.maths.qmul.ac.uk/~pjc/notes/nt.pdf		

Course programme designed by

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