KAPITAŁ LUDZKI
NARODOWA STRATEGIA SPÓJNOŚCI
Projekt współfinansowany przez Unię Europejską w ramach Europejskiego Funduszu Społecznego
UNIA EUROPEJSKA
EUROPEJSKI FUNDUSZ SPOŁECZNY

Course title	ECTS code
Number theory	11.1.0331

Name of unit administrating study

null

Studies

faculty	field of study		
Faculty of Mathematics, Physics and Informatics	Mathematics	type	first tier studies (BA)
		form	full-time
		specialty	null, mathematics – teacher education
		specialization	all
Faculty of Mathematics, Physics and Informatics	Mathematics	type	second tier studies (MA)
		form	full-time
		specialty	theoretical mathematics, financial mathematics, mathematics – teacher education
		specialization	all
Faculty of Mathematics, Physics and Informatics	Mathematical Modeling and Data Analysis	type	second tier studies (MA)
		form	full-time
		specialty	all
		specialization	all

Teaching staff

dr Ewa Kozłowska-Walania; dr Marcin Szyszkowski; dr Poj Lertchoosakul; dr Piotr Zarzycki; Marta Kwela

Forms of classes, the realization and number of hours

Forms of classes

Auditorium classes, Lecture

The realization of activities

classroom instruction

Number of hours

Lecture: 30 hours, Auditorium classes: 30 hours

ECTS credits

5

The academic cycle

2022/2023 summer semester

Type of course

an elective course

Language of instruction

- english
- polish

Teaching methods

- conducting experiments
- multimedia-based lecture
- problem solving

Form and method of assessment and basic criteria for eveluation or examination requirements

Final evaluation

- Graded credit
- Examination

Assessment methods

- (mid-term / end-term) test
- graded course credit based on individual grades obtained during the semester
- written exam (long written answer/problem solving)
- oral exam

The basic criteria for evaluation

Method of verifying required learning outcomes

Required courses and introductory requirements

A. Formal requirements

None.

B. Prerequisites

A usual course in Foundations of Mathematics and course in Algebra

Aims of education

The goal of this course is to make students familiar with notions, theorems and methods of elementary number theory.

Course contents

1. Properties of divisibility relation defined on the set of integers.
2. Euclidean algorithm.
3. Prime numbers.
4. Congruences and their properties.
5. Quadratic reciprocity law.
6. Basic Diophantine equations.
7. Continued fractions and their properties.
8. Approximating real numbers by rational numbers.
9. Arithmetic functions - algebraic properties and analytic properties.

Bibliography of literature

1. W. Marzantowicz, P. Zarzycki, *Elementarna teoria liczb*, PWN, Warszawa 2006
2. W. Narkiewicz, *Teoria liczb*, PWN, Warszawa 1990
3. L. K. Hua, *Introduction to Number Theory*, Springer, 1982
4. H. Davenport, *The Higher Arithmetic*, Cambridge University Press, 2008

The learning outcomes (for the field of study and specialization)

Knowledge

Student:

- has a deepened knowledge on elementary number theory
- thoroughly understands the role and meaning of a structure of a mathematical reasoning
- knows well at least one software package for symbolic and numerical computations
- knows the fundamental definitions and theorems in elementary number theory, in particular: the division theorem, the proof for correctness of the Euclidean algorithm, the fundamental theorem of arithmetic, the theorem about the infiniteness of the set of primes,
- knows the definition and basic properties of congruence, in particular Fermat's little theorem, Euler theorem, Chinese remainder theorem and the law of quadratic reciprocity
- knows theorems concerning diophantine equations, in particular linear equations and Pythagorean equation
- knows theorms concerning continued fractions, in particular knows theorems concerning best approximations of irrational numbers (holding certain conditions) with rational numbers.
- knows examples of transcendental numbers, in particular knows the Liouville theorem concerning examples of such numbers.
- knows definitions and theorems concerning algebraic and analytic properties of ariithmetic functions, in partiular the divisor functions and Euler totient function.

M2_W01, M2_W02, M2_W03

Skills

Student:

- has an ability to develop mathematical reasonings: proving theorems and disproving hypotheses by contruction and a proper choice of counterexamples.
- understands proofs of theorems given during classes and is able fill the gaps in less difficult proofs.
- applies the methods and examples from number theory to other fields of mathematics.
- applies known theorems to solve exercises concerning for example divisibility of integers or integer factorization.
- uses congruences to solve exercises concerning divisibility of integers or diophantine equations.

	• is able to find all solutions, or solutions holding given conditions, of some diophantine equations, in particular linear and Pythagorean equations. • is able to represent real numers as continued fractions and switch some types of continued fractions to real numbers. • is able to prove the irrationality of some real numbers, like Sqrt{2} or e. • is able to determine properties (like being multiplicative) of some arithmetic functions. • uses software packages (with built-in number theory modules, like MAPLE, MATHEMATICA) to solve exercises and pose hypotheses. M2_U01, M2_U03, M2_U04, M2_U05, M2_U06, M2_U07
	Social competence

Contact

ewa.kozlowska-walania@ug.edu.pl