

MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATION
OF THE REPUBLIC OF UZBEKISTAN
CHIRCHIK STATE PEDAGOGICAL UNIVERSITY



SYLLABUS
OF ALGEBRA AND NUMBER THEORY
(Form of education: full-time 2-course).

Fields of knowledge:

100000 – Education

Fields of education:

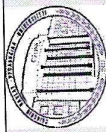
110000 – Education

Educational direction:

60110600 – Mathematics and informatics

Chirchik – 2024

14



Syllabus of subject

Academic year:	2024/2025		
Subject name:	Algebra and number theory		
Subject type:	Compulsory		
Subject code:	ASNM 1129 ✓		
Year:	4 ✓		
Form of education:	Full-time		
Type of education:	Bachelor degree		
Course format and semester hours:	Total	3 rd semester	4 th semester
	240	120 ✓	120 ✓
	60	30 ✓	30 ✓
	60	30 ✓	30 ✓
	—	—	—
Lecture	—	—	—
Practical lesson	—	—	—
Laboratory lesson	—	—	—
Seminar	—	—	—
Self-study	120	60 ✓	60 ✓
Amount of credit:	8	4 ✓	4 ✓
Evaluation form:	Summative	Verbal and in written form	Verbal and in written form
	Final control	in written form	in written form
Responsible department for subject: Algebra and Mathematical Analysis			

Information about the teacher of subject

The author:	Raupova Mokhinur Haydar qizi
E-mail:	r.mokhinur@gmail.com
Phone number	(90) 336-37-11
Organization:	Department of "Algebra and Mathematical Analysis", Chirchik State Pedagogical University
Reviewers:	J. Adashev - V. Ramanovskiy Institute of Mathematics, Ph.D.-M.Ph.D. Professor. A.G. Abdurakhmanov - senior teacher of the "Algebra and Mathematical Analysis" department of the "Mathematics and Informatics" Faculty of Chirchik State Pedagogical University.

The purpose of subject (PS)	
PS1	The main goal of taking the course on algebra and number theory is to teach students about groups, fields, rings, isomorphism, and the applications of examples and problems related to these topics. Through these subjects, the aim is to expand students' thinking abilities. The subject of algebra and number theory involves mastering the content of mathematical concepts, rules, and methods through conscious understanding, acquiring a culture of thinking, comprehending, generalizing, and analyzing information, setting goals, and choosing ways to achieve them.

Basic knowledge necessary for learning subject	
1.	Mathematics
2.	Algebra
3.	Geometry

Educational results (ER)	
<i>In terms of a knowledge perspective:</i>	
ER1	Demonstrate a deep understanding of the concepts and principles of algebra and number theory;
ER2	In-depth analysis of the essence of algebra and number theory methods;
ER3	In order to solve problems in his professional activity, he acquires knowledge, qualifications and skills in the fields of mathematical analysis, algebra and number theory, geometry, differential equations, probability theory, and participates in scientific research.
ER4	Algebra and number theory course problems (examples and problems) are presented and students are given the opportunity to practice applying the mathematical methods and techniques necessary to solve them.
<i>In terms of skills:</i>	
ER5	It is carried out through students' collective and individual implementation of given practical examples or problems.
ER6	The student studies the given problem and conducts research, understanding the goals and objectives and essence of the given examples or problems.
ER7	Analyzes the obtained results, prepares presentations with solutions and defends them.

Subject content			Hours
Form of education: Lecture (L)			
First half-year			
L1	Divisibility rules. Greatest common divisor (GCD) and least common multiple (LCM).		2
L2	Continuous and proper fractions.		2
L3	Prime numbers. Fundamental theorem of arithmetic.		2
L4	Congruences and their properties.		2
L5	Multiplicative functions. Euler's and Fermat's theorems.		2
L6	First-degree congruences. Chinese remainder theorem.		2
L7	n-th degree congruences for arbitrary modulus. Legendre and Jacobi symbols.		2
L8	Binary relations. Equivalence relation.		2
L9	Binary operation, semigroup, monoid, and groups.		2
L10	Permutation group. Subgroups. Cyclic groups.		2
L11	Cosets. Lagrange's theorem. Normal subgroups and factor groups.		2
L12	Centralizer, normalizer, and commutator.		2
L13	Group homomorphism and isomorphism. Isomorphism theorems.		2
L14	Direct and semidirect product of groups. Finite abelian groups.		2
L15	Group action on a set. Sylow theorems. Some applications of Sylow theorems.		2
TOTAL			30
Form of education: Lecture (L)			
Second half-year			
L1	Finite simple groups.		2
L2	Classification of small order groups.		2
L3	Solvable groups.		2
L4	Nilpotent groups.		2
L5	Rings, fields, and domains. Quotient ring.		2
L6	Finite fields. Characteristic of a field.		2
L7	Nilpotent and idempotent elements of a ring. Boolean and regular rings.		2
L8	Subrings and subfields. Ideals of a ring. Factor rings.		2
L9	Ring homomorphisms and isomorphisms.		2
L10	Homomorphism theorems (for rings).		2
L11	Principal ideal domain (PID).		2
L12	Types of ideals. Nilpotent, maximal, and prime ideals. Prime and irreducible elements.		2
L13	Maximal, prime, and primary ideals.		2
L14	Direct sum of rings.		2
L15	Noetherian and Artinian rings.		2
TOTAL			30

				answers to questions lack accuracy and completeness; makes some mistakes in the presentation of materials;
F	Below 3,0	Below 59	not satisfactory	did not master the materials; cannot answer questions; does not participate in training

Basic and additional educational literature and information sources

Basic literature	
1.	Ayupov Sh.A., Omirov B.A., Khudoyberdiyev A.Kh., F.H. Haydarov, Algebra and number theory, Tashkent, Uzbekistan 2019. 319b.
2.	Ayupov Sh.A., Omirov B.A., Khudoyberdiyev A.Kh., Abstract Algebra, Tashkent, Uzbekistan 2022.
3.	Hajiyev J., Feinleib A.S. Algebra and number theory course, Tashkent, Uzbekistan 2001. 304b.
Additional literature	
1.	D.K. Fadeev, Lectures on algebra, St. Petersburg: Lan, 2005.
2.	A.L. Kostrikin, Collection of problems in algebra, M.: Fizmatlit, 2001.
Internet sites	
1.	http://www.edu.uz - Ministry of Higher Education, Science, and Innovations of the Republic of Uzbekistan.
2.	http://www.gov.uz - Uzbekistan Republic Government Portal.
3.	www.ziyoux.uz - Information Education Network of the Republic of Uzbekistan
4.	www.cspi.uz - CSPU website
5.	www.natlib.uz - (A. Navoi National Library of Uzbekistan).

This Syllabus was approved by the "Algebra and mathematical analysis" department in the meeting No. __ dated __ - __ 2024.

This Syllabus was approved by the "Mathematics and informatics" faculty in the meeting No. __ dated __ - __ 2024.

This Syllabus was approved by the Council of Chirchik State Pedagogical University in the meeting No. __ dated __ - __ 2024.

Head of the educational and methodological department

M.J. Boltayev

The dean of the faculty

D.M. Maxmudova

The head of the department

G.X. Djumabayev

Creator

M.H. Raupova

$\Sigma MI = \Sigma CC + \Sigma IC + FCA$ The module (subject) is considered mastered when a score higher than $\Sigma MI \geq 60$ score.				
Criteria for assessing the educational results of students:				
Level	5 score system (point)	Appropriation in percent	In traditional	Assessment criteria
For the education department				
For professors and teachers				
A+	4,51 – 5	91 – 100	Excellent	The student quickly learns the material independently; he does not make mistakes; actively participates in training; answers questions completely and clearly.
A	4,26 – 4,5	86 – 90		the student learns the materials independently; does not make mistakes; answers questions completely and clearly.
B+	4,01 – 4,25	81 – 85		the student has mastered the material well, can express it logically; actively participates in training; answers questions completely and accurately, but makes minor mistakes.
B	3,51 – 4,0	71 – 80	Good	the student has mastered the material well, answers the questions fully and accurately, but makes minor mistakes.
C+	3,26 – 3,5	66 – 70		knows basic material but struggles to express clearly; answers to questions lack accuracy and completeness; makes some mistakes in the presentation of materials; feels difficulty in the process of communication.
C	3,0 – 3,25	60 – 65	Satisfactory	knows basic material but struggles to express clearly;

Activity format: Practical (P)		
First half-year		
P1	Divisibility rules. Greatest common divisor (GCD) and least common multiple (LCM).	2
P2	Continuous and proper fractions.	2
P3	Prime numbers. Fundamental theorem of arithmetic.	2
P4	Congruences and their properties.	2
P5	Multiplicative functions. Euler's and Fermat's theorems.	2
P6	First-degree congruences. Chinese remainder theorem.	2
P7	n-th degree congruences for arbitrary modulus. Legendre and Jacobi symbols.	2
P8	Binary relations. Equivalence relation.	2
P9	Binary operation, semigroup, monoid, and groups.	2
P10	Permutation group. Subgroups. Cyclic groups.	2
P11	Cosets. Lagrange's theorem. Normal subgroups and factor groups.	2
P12	Centralizer, normalizer, and commutator.	2
P13	Group homomorphism and isomorphism. Isomorphism theorems.	2
P14	Direct and semidirect product of groups. Finite abelian groups.	2
P15	Group action on a set. Sylow theorems. Some applications of Sylow theorems.	2
TOTAL		30
Activity format: Practical (P)		
Second half-year		
P1	Finite simple groups.	2
P2	Classification of small order groups.	2
P3	Solvable groups.	2
P4	Nilpotent groups.	2
P5	Rings, fields, and domains. Quotient ring.	2
P6	Finite fields. Characteristic of a field.	2
P7	Nilpotent and idempotent elements of a ring. Boolean and regular rings.	2
P8	Subrings and subfields. Ideals of a ring. Factor rings.	2
P9	Ring homomorphisms and isomorphisms.	2
P10	Homomorphism theorems (for rings).	2
P11	Principal ideal domain (PID).	2
P12	Types of ideals. Nilpotent, maximal, and prime ideals. Prime and irreducible elements.	2
P13	Maximal, prime, and primary ideals.	2
P14	Direct sum of rings.	2
P15	Noetherian and Artinian rings.	2
TOTAL		30
Independent Learning (IL)		
First half-year		

IL1	Divisibility rules	2
IL2	GCD and LCM	2
IL3	Continued fractions	2
IL4	Prime numbers	2
IL5	Fundamental theorem of arithmetic	2
IL6	Congruences	2
IL7	Multiplicative functions	2
IL8	Euler's and Fermat's theorems	2
IL9	Linear congruences	2
IL10	Chinese remainder theorem	2
IL11	Higher degree congruences	2
IL12	Legendre and Jacobi symbols	2
IL13	Binary relations	2
IL14	Equivalence relation	2
IL15	Binary operation, semigroup	2
IL16	Monoid and group	2
IL17	Permutation group	2
IL18	Subgroups	2
IL19	Cyclic groups	2
IL20	Cosets	2
IL21	Lagrange's theorem	2
IL22	Normal subgroups and factor groups	2
IL23	Centralizer, normalizer, commutator	2
IL24	Group homomorphism and isomorphism	2
IL25	Isomorphism theorems	2
IL26	Direct and semidirect product	2
IL27	Finite abelian groups	2
IL28	Group action	2
IL29	Sylow theorems	2
IL30	Applications of Sylow theorems	2
TOTAL		60
Independent Learning (IL)		
Second half-year		
IL1	Finite simple groups	4
IL2	Classification of small order groups	2
IL3	Solvable groups	2
IL4	Nilpotent groups	2
IL5	Rings	4
IL6	Fields.	2
IL7	Domains: Integral domain.	2
IL8	Quotient ring	2
IL9	Finite fields	2
IL10	Characteristic of a field:	4

IL11	Nilpotent elements	2
IL12	Idempotent elements	2
IL13	Boolean rings	2
IL14	Regular rings	2
IL15	Subrings and subfields	2
IL16	Ideals of a ring	4
IL17	Factor rings	2
IL18	Ring homomorphisms and isomorphisms	2
IL19	Homomorphism theorems (for rings)	2
IL20	Principal ideal domain (PID)	2
IL21	Types of ideals	4
IL22	Prime and irreducible elements	2
IL23	Primary ideals	2
IL24	Basic and non-derived elements	2
IL25	Maximal, prime, and primary ideals.	2
TOTAL		60

VIII. Requirements for obtaining a credit::

Full mastery of theoretical and practical concepts of science, ability to correctly reflect the results of analysis, independent observation of the studied processes, creation and current, intermediate control forms of tasks and assignments given in writing or orally execution, passing tests on final control.

IX. Criteria for evaluation and control of student knowledge in science

The educational results of students are evaluated in a 100-point rating system. The conversion of points for the educational results by students is carried out on the basis of the ECTS (European Credit Transfer System) system.

Points for evaluation of educational results are determined in the following order:

Auditorium lessons for the completion of assigned tasks - current assessment (CA); Assessment of self-study on completing independent learning tasks (ASS);	For answers during the intermediate control - intermediate control assessment (ICA);	For answers during the final control - final control assessment (FCA)
<i>The maximum score of the current control 15+15=30 score: $\Sigma CC = CA + ASS$</i>	<i>The maximum score of the intermediate control 20 score: $\Sigma IC = ICA + ASS$</i>	<i>The maximum score of the final control (FCA) 50 score.</i>
<i>A student is allowed to pass the final exam when he has a score higher than $\Sigma CC + \Sigma IC > 30$</i>		
Mastery indicator from the module (subject). (MI):		