

MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATION OF
THE REPUBLIC OF UZBEKISTAN

CHIRCHIK STATE PEDAGOGICAL UNIVERSITY



WORKING CURRICULUM (SYLLABUS)

BY DISCIPLINE

DISCRETE MATHEMATICS AND MATHEMATICAL LOGIC

(Full-time 1-year course)

Field of knowledge:

500000 - Natural Sciences, Mathematics and
Statistics

Field of education:

540000 - Mathematics and Statistics

Direction of education:

60540200-Mathematics

Chirchik – 2024



SUBJECT SYLLABUS

Academic year:	2024/2025			
Subject name:	Discrete Mathematics and Mathematical Logic			
Subject Type:	Mandatory			
Subject Code:	DMMM11209			
Year:	4			
Form of training:	Full-time			
Type of education:	Bachelor			
The format of classes and hours allocated per semester:	Total	1 semester	2 semester	
	270	150	120	
	60	30	30	
	60	30	30	
	—	—	—	
	—	—	—	
	150	90	60	
Credit quantity:	9	5	4	
Assessment form:	M. E. 1,2,2	In written	In written	
Responsible department for the subject:	Final control	In written	in written	
	Algebra and Mathematical Analysis			

Information about the teacher

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This curriculum was approved by the Department of Algebra and Mathematical Analysis at the meeting no. ___ of ___ - ___ 2024.
This curriculum was approved by the Faculty of Mathematics and Computer Science at the meeting no. ___ of ___ - ___ 2024.
This curriculum was approved by the Council of Chirchik State Pedagogical University at the meeting no. ___ of ___ - ___ 2024.

Head of the Educational and
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M.J. Boltaev

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Compiled by

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1. The Purpose of Science (PS)	
PS 1	The main goal of the discrete mathematics and mathematical logic course is to familiarize students with the essential information in mathematics (concepts, statements and their proofs, methods for solving practical problems, etc.).

2. Basic knowledge required to master science	
1.	Algebra
2.	Combinatorics and Graphs

3. Learning Outcomes (LO)	
<i>In terms of knowledge:</i>	
LO1	Demonstrate a deep understanding of the concepts and principles of discrete mathematics and mathematical logic;
LO2	Conduct an in-depth analysis of the essence of discrete mathematics and methods of mathematical logic;
LO3	Acquire knowledge, skills, and abilities in the fields of mathematical analysis, algebra, number theory, combinatorics, and graph theory to solve problems in professional activities, and participate in scientific research;
LO4	Present the tasks of the course in discrete mathematics and mathematical logic (examples and problems), providing students with the opportunity to practice applying the necessary mathematical methods and techniques to solve them;

<i>In terms of skills:</i>	
LO5	It is carried out through the collective and individual implementation by students of given practical examples or tasks.
LO6	The student studies the assigned problem, conducts research, understanding the goals and objectives and the essence of the given examples or problems.
LO7	The student analyzes the obtained results, prepares presentations with solutions and defends them.

4. Content of science	
Form of study: lecture (L)	
1st half of the year	
L1	Sets and operations on them. Set algebra. Inclusion-exclusion principle. 2
L2	General concepts of combinatorics. 2

L3	Newton's binomial. Pascal's triangle. Fibonacci numbers.	2
L4	Repeating combinations.	2
L5	Inclusion-exclusion formula.	2
L6	Sets and operations on them. Logical connectives. Truth table.	2
L7	Equivalent formulas and theorems related to them.	2
L8	Derived formulas. DNF, CNF. Complete systems of logical operations.	2
Midterm exam		
L9	Normal forms. Complete disjunctive and conjunctive normal forms.	2
L10	Algebraic functions of statements.	2
L11	Formal axiomatic theory. Propositional logic.	2
L12	Derived rules.	2
L13	Concept of proof.	2
L14	Completeness theorem.	2
L15	Concept of predicate. Logical operations on predicates.	2
Total		30
2nd half of the year		
L1	Quantifiers of universality and availability.	2
L2	Formulas of predicate algebra.	2
L3	Solving problems in predicate algebra. Equivalent strength of formulas in predicate algebra.	2
L4	Normal canonical forms of formulas. Applications of predicate algebra.	2
L5	Predicate calculus.	2
L6	The problem of minimizing functions in mathematical logic.	2
L7	The problem of minimizing functions in mathematical logic.	2
L8	The problem of minimizing functions in mathematical logic.	2
Midterm exam.		
L9	Elements of graph theory.	2
L10	Elements of graph theory.	2
L11	Directed graphs. Transitive graphs. Bicomponents of graphs.	2
L12	Coloring graphs. Chromatic numbers.	2
L13	Trees and their applications. Walking through trees. Basic trees.	2
L14	Concept of an algorithm. Responsibility. Turing machine. Primitive recursive functions. Partially recursive and recursive functions.	2
L15	Non-recursive countable sets. The parking problem. Algorithmically unsolvable problems.	2
Total		60
Form of classes: Practical (P)		
1st half of the year		
P1	Sets and operations on them. Set algebra. Inclusion-exclusion principle.	2

"4"	3.5 – 4.4949	"B+"	80 — 89.9	Good
		"B"	70 – 79.9	
"3"	3 – 3.49	"C+"	65 — 69.9	Satisfied
		"C"	60 — 64.9,9	
"2"	0 – 2.99	"F"	0-59.9	Unsatisfied

Basic and additional educational literature and information resources

Basic literature	
1.	Н.Х.Қосимов, "Дискрет математика ва математик мантик асослари". Донишманд Зиёси 2020 ЎзР ОЎМТВ
2.	Тўраев Х., Математик мантик ва дискрет математика. Тош. Ўқитув 2003..
3.	Тўраев Х., "Комбинаторика ва графлар назарияси" Тош. Ўқитув 2003.
4.	N.X.Kasimov, " Diskret matematika". VNESHINVESTPROM-2019 O'zROOMTV
Additional literature	
1.	Юнусов А.С. Математик мантик ва алгоритмлар назарияси элементлари. Тош. янги аср авлод 2006
2.	Нефедов В.Н., Осипова В.А. Курс дискретной математики. М.: МАИ, 1992.- 267 s.
3.	Джеймс А. Андерсон. Дискретная математика и комбинаторика. Москва. Санкт Петербург. Киев, 2004.- 959 s
4.	Аляев Й.А., Тюрин С.Ф. Дискретная математика и математическая логика. Учебник, Москва. Финансы и статистика. 2006. -366 s
5.	Яблонский. Введение в дискретную математику. 1986, Москва, "Наука"
Internet sites	
1.	http://www.edu.uz -Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan.
2.	www.ziyounet.uz -Educational information network of the Republic of Uzbekistan
3.	www.cspl.uz -website of Chirchik State Pedagogical University
4.	www.natlib.uz - Alisher Navoi National Library of Uzbekistan

form of current and intermediate control, perform written tasks based on options for final control.			
8. Criteria for evaluating and controlling knowledge of students on the subject Student educational outcomes are assessed using a 100-point grading system. The conversion of scores based on students' learning outcomes is carried out according to the YeCTS (European Credit Transfer System).			
The points for assessing educational outcomes are determined in the following manner:			
Midterm exam		The final exam	
For answers during the midterm assessment – midterm assessment score (MAS); For completing independent study assignments – independent work assessment (ISA); The performance of the student in practical, seminar, laboratory classes, and independent study assignments, as well as their activity in these exercises, is evaluated by the natural science teacher. When assessing the student based on the type of midterm assessment, the grades received in the academic classes are taken into account. For answers during the midterm exam – midterm assessment score (MES); For completing independent study assignments – independent work assessment (ISA); The performance of the student in practical, seminar, laboratory classes, and independent study assignments, as well as their activity in these exercises, is evaluated by the natural science teacher. When assessing the student based on the type of interim assessment, the grades received in the academic classes are taken into account.		Assessment for the final control for participation in the final exam (AFE)	
The maximum point midterm exam score is 5 points: $\Sigma ME = MAS + ISA$		Maximum score of the final exam (MSFE) 5 points	
A student with a score of $\Sigma PE \geq 3$ is allowed to pass the final exam. Module Assimilation Rate (MAR): $\Sigma MAR = MAS$			
The module is considered mastered when $\Sigma MAR \geq 3$ is obtained.			
Criteria for Assessing Educational Outcomes of Students:			
"5"	4.5 – 5	"A"	90-100
			Excellent

P2	General concepts of combinatorics.	2
P3	Newton's binomial. Pascal's triangle. Fibonacci numbers.	2
P4	Repeating combinations.	2
P5	Inclusion-exclusion formula.	2
P6	Sets and operations on them. Logical connectives. Truth table.	2
P7	Equivalent formulas and theorems related to them.	2
P8	Derived formulas. DNF, CNF. Complete systems of logical operations.	2
P9	Normal forms. Complete disjunctive and conjunctive normal forms.	2
P10	Algebraic functions of statements.	2
P11	Formal axiomatic theory. Propositional logic.	2
P12	Derived rules.	2
P13	Concept of proof.	2
P14	Completeness theorem.	2
P15	Concept of predicate. Logical operations on predicates.	2
Total		30
2nd half of the year		
P1	Quantifiers of Universality and Existence.	2
P2	Formulas of Predicate Algebra.	2
P3	Solving Problems in Predicate Algebra. Equivalent Strength of Formulas in Predicate Algebra.	2
P4	Canonical Normal Forms of Formulas. Applications of Predicate Algebra.	2
P5	Predicate Calculus.	2
P6	The Problem of Minimizing Mathematical Logic Functions.	2
P7	The Problem of Minimizing Mathematical Logic Functions.	2
P8	The Problem of Minimizing Mathematical Logic Functions.	2
P9	Elements of Graph Theory.	2
P10	Elements of Graph Theory.	2
P11	Directed Graphs. Transitive Graphs. Bicomponents of Graphs.	2
P12	Graph Coloring. Chromatic Numbers.	2
P13	Trees, Their Application. Walking Through Trees. Basic Trees.	2
P14	The Concept of an Algorithm. Responsibility. Turing Machine. Primitive Recursive Functions. Partially Recursive and Recursive Functions.	2
P15	Non-Recursive Countable Sets. The Parking Problem. Algorithmically Undecidable Problems.	2
Total		30

5. Independent learning (IL)	
1st half of the year	
IL1	Historical data on discrete mathematics and mathematical logic.
	2

IL2	Collections and actions on them. Set algebra. Input-output rule. Definition of the number of elements of a set, input-output rules.	2
IL3	Relations. Relational algebra. Multiplicity of binary relations.	2
IL4	Function. Special binary relations. Equivalence relation. Partially ordered sets.	2
IL5	Reasoning, logical actions, formula, part of a formula, truth table.	2
IL6	Logical connectives. Algebra of reasoning. Porcelain table. Formula, part of a formula.	2
IL7	Equivalent force of formulas. Basic equalities of the algebra of reasoning.	2
IL8	Equivalent force, equivalent strong replacements, tautology. Theorems on equally strong formulas.	2
IL9	Derived formulas. Complete systems of logical operations.	2
IL10	Normal formulas. Ideal disjunctive and conjunctive-normal formulas.	2
IL11	Applications of algebra of reasoning formulas. Solving logical problems.	2
IL12	Relay-contact circuits.	2
IL13	Formal axiomatic theory. Feedback accounting.	2
IL14	Derivative production rules.	2
IL15	Syllogism, opposition, rule of double negation dropping.	2
IL16	Deduction theorem. Applications of the deduction theorem.	4
IL17	Problem of completeness, consistency, freedom, decidability of axiomatic theory.	4
IL18	Elementary Boolean functions. Their methods of presentation.	4
IL19	Essential and false variables.	4
IL20	Important closed classes. Complete systems.	4
IL21	Dual functions. Principle of duality.	4
IL22	This is the decomposition of a function into a Zhegalkin polynomial.	4
IL23	Complete system of functions.	4
IL24	Post's theorem and its results.	4
IL25	Concept of a predicate. Invariant and variable considerations.	4
IL26	Logical operations on predicates.	4
IL27	Universal and existential quantifiers. Finite quantifiers.	4
IL28	Logical square. Formulas of predicate algebra.	4
IL29	Executable, refutable formulas, exactly true, exactly false formulas.	4
IL30	Equivalent force of formulas in predicate algebra.	4
Total		90
2nd half of the year		
IL1	Formulas of equal force, basic equal forces.	2
IL2	Universally significant formulas.	2
IL3	Applications of predicate algebra. Accounting for predicates.	2

IL4	Basic elements of combinatorics.	2
IL5	Newton's binomial. Fibonacci numbers.	2
IL6	Repeating combinations.	2
IL7	The concept of an algorithm.	2
IL8	Partially recursive functions.	2
IL9	Turing machine. Implementing algorithms on a Turing machine.	2
IL10	Markov's normal algorithm.	2
IL11	Recurrent relations.	2
IL12	Definition of the general limit of recurrent relations.	2
IL13	Graphs and ways to represent them. Types of graphs.	4
IL14	Graph, graph vertices, graph edge, loop, adjacency matrix, incidence matrix.	4
IL15	Graph traversal. Euler and Hamiltonian graphs.	4
IL16	Euler cycle. Fleury's algorithm. Cyclomatic number.	4
IL17	Directed graphs. Transitive graphs.	4
IL18	Bicomponents of graphs. Graph coloring.	4
IL19	Chromatic numbers. Graph coloring algorithms, defining the chromatic number.	4
IL20	Trees. Tree search algorithms. Graph encoding.	4
IL21	Formulas of equal force, basic equal forces.	4
Total		60

6. Educational technologies and methods:

Lectures - interactive case studies; seminars (reasoning, quick questions and answers); working in groups; conducting presentations; individual projects; projects for collaboration and defense.

Practical classes include solving problems related to the topic, making practical observations, making measurements, and working with astronomical tables.

Independent work - it is recommended to carry out in the following types:

- preparation of reports;
- preparation of presentations;
- problem solving;
- individual and group educational project;
- work with information and analytical materials;
- working with resources.
- drawing and illustrative models (smart map, frame, logical graph, etc.) k.) create;
- creation of multimedia presentations;
- preparation of methodological developments of lessons;
- preparation of extracurricular developments;

7. Requirements for obtaining credits:

It is necessary to fully master the theoretical and methodological concepts related to science, be able to correctly reflect the results of analysis, independently observe the processes and concepts being studied, perform tasks and tasks in the