New Uzbekistan University

School of Humanities, Natural and Social Sciences
Department of Mathematics

Course Syllabus

Course title: Discrete Mathematics
Course code: MATH 221

Spring Semester
2025

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Department of Mathematics

Course Syllabus

Course Title	Discrete Mathematics		
Course Code	MATH 221		
Credits / ECTS	3 Credits / 6 ECTS	**Total Hours**	180
Contact hours per week	Lectures / Tutorials	2 hours / 2 hours	
Pre-requisite	Pre-calculus		
Semester	2	**Academic Year**	2025
Course leader	Rustam Turdibaev		
Email	r.turdibaev@newuu.uz		
Office Number	216		
Office Hours	Tuesday, 10:00-12:00		
Textbook	Kenneth H. Rosen, Discrete mathematics and its applications, 8th edition, Mc Graw Hill, 2019.		

Course Description (as in the catalog):

Course Instructors:

Position	Name	Email	Office	Office hours
Lecture/Tutorial	Rustam Turdibaev	r.turdibaev@newuu.uz	216	TBA
Tutorial	Alisher Ikramov	a.ikramov@newuu.uz	216	Wednesday, 10:00-11:30

Attendance policy:

Attendance is compulsory.

Course Learning Outcomes (CLOs):

By the end of successful completion of this course, the student will be able to:

Week	Topic
CLO1	Effectively write mathematical solutions in a clear and concise manner.
CLO2	Locate and use information to solve discrete mathematics problems.
CLO3	Demonstrate ability to think critically by demonstrating an understanding of logic, algebraic and algorithmic calculi.
CLO4	Demonstrate ability to think critically by recognizing patterns and determining and using appropriate techniques for solving a variety of combinatorics problems.
CLO5	Demonstrate the ability to think critically by designing and finding complexities of elementary algorithms.
CLO6	Work effectively with others to solve problems during the tutorial. This will be assessed through class discussions.

Alignment of Course Learning Outcomes to Program Outcomes

Alignment of Course Learning Outcomes(CLOs) to Student/Program Outcomes of Programs

CLO	Software Engineering	Cybersecurity	Artificial Intelligence & Robotics	Applied Mathematics	Pedagogy
CLO1	SO3, SO6	SO3	SO3	SO3	
CLO2	SO1	SO1	SO1	SO1	
CLO3	SO1, SO7	SO1, SO7	SO1, SO7	SO1	
CLO4	SO1, SO6	SO1, SO6	SO1, SO6	SO1	
CLO5	SO1	SO1	SO1	SO1	
CLO6	SO5, SO3	SO5, SO3	SO5, SO3	SO5, SO3	

Weekly Distribution of Course Topics/Contents

Week	Class Type	Topic	Required Reading	Course Learning Outcome
1	Lecture	Introduction to the course. Propositional Logic: propositions, logical operations, truth tables. Applications of Propositional Logic: translation from logic into language and vice versa, system specifications, logical puzzles.	Chapters 1.1, 1.2, A-11,	CLO3, CLO1, CLO2
	Tutorial	Problems from Sections 1.1, 1.2		
2	Lecture	Propositional Equivalences: tautologies, various laws of equivalences. Disjunctive normal form. Predicates and Quantifiers: universal and existential quantifiers, equivalence of statements involving predicates, translations logic vs. language.	Chapter 1.3, 1.4	CLO3, CLO1, CLO2
	Tutorial	Problems from Sections 1.3, 1.4		
3	Lecture	Nested quantifiers: equivalence of the nested quantifiers, rules of negation, translation logic vs. language. **Independent Study:** Rules of Inference: logical syllogisms	Chapters 1.5, 1.6	CLO3, CLO1, CLO2
	Tutorial	Problems from Sections 1.5, 1.6		

Week	Class Type	Topic	Required Reading	Course Learning Outcome
4	Lecture	Proof Methods and Basic Structures: Sets, Functions, Sequence, Boolean Matrices	Chapter 1.7, 1.8, Chapter 2	CLO3, CLO1, CLO2
	Tutorial	Problems from Sections 1.5, 1.6		
5	Lecture	Growth of Functions: Big O, Theta, Omega; Halting Problem	Chapters 3	CLO5, CLO1, CLO2
	Tutorial	Problems from Sections		
6	Lecture	Mathematical Induction: mistaken proofs, creative use of induction; Strong Induction: use of strong induction in algorithm correctness;	Chapters 5.1, 5.2	CLO1, CLO2
	Tutorial	Problems from Sections		
7	Lecture	Revision sessions		CLO1, CLO2
	Tutorial	Problems from Revision Sections		
8		Midterm Exam		
9	Lecture	Recursive definitions and Structural Induction: recursively defined functions, Lame Theorem on complexity of the Euclidean algorithm, recursive definition of binary trees **Independent study:** Program Correctness - Ch5.5	Chapters 5.3, 5.4	CLO5, CLO1, CLO2
	Tutorial	Going over the Midterm Exam		
10	Lecture	Basics of Counting. Generalized Pigeonhole Principle. Permutations and Combinations. Applications of Recurrence Relations. Proof that O(nlogn) comparisons needed to sort an array.	Chapter 6.1, 6.2, 6.3, 8.1	CLO5, CLO1, CLO2
	Tutorial	Problems from Sections 5.1, 5.2, 5.3		
11	Lecture	Solving Linear Recurrence Relations Recursion revisited. Divide-and-Conquer Algorithms algorithms: modeling using recursion, Master theorem, Karatsuba algorithm of fast multiplication, complexity divide-and-conquer algorithms (Mergesort included), elegant solution of finding closest points on the plane.	Chapters 8.1, 8.2, 8.3	CLO5, CLO1, CLO2
	Tutorial	Problems from Sections 6.2, 8.2		

Week	Class Type	Topic	Required Reading	Course Learning Outcome
12	Lecture	Relations: types of relations (reflexive, symmetric, transitive), combining relations, composition; Equivalence Relations: equivalence classes and partitions; Partial Orderings: the principle of well-ordered induction, lexicographical order, max and min elements, lattices, topological sort	Chapters 9.1, 9.5, 9.6	CLO3, CLO1, CLO2
	Tutorial	Problems from Sections 8.1, 8.3		
13	Lecture	Graph terminology and special types. The handshake lemma, Bipartite graphs, Hall's Marriage Theorem, Hypercube and parallel processing. Graph Representation and Isomorphism: algorithms for graph isomorphisms. Connectivity.	Chapters 10.2, 10.3, 10.4	CLO3, CLO1, CLO2
	Tutorial	Problems from Sections 10.2, 10.3,		
14	Lecture	Euler and Hamiltonian Paths: necessary and sufficient conditions, Dirac and Ore's theorems, Gray codes. Planar Graphs: Euler's formula, graph homeomorphisms, Kuratowski's Theorem.	Chapters 10.5, 10.7, 10.8	CLO3, CLO1, CLO2
	Tutorial	Problems from Sections 10.5, 10.7, 10.8		
15	Lecture	Revision sessions	Review	
	Tutorial	Revision		
16		**Final Exam**		

Students' Assessment:

Students are assessed as follows:

Assessment Tool(s)**	Date	Weight (%)
Tutorial Activities		20
Midterm exam		40
Final exam		40

Assessment Tool(s)**	Date	Weight (%)
Total		**100**

Students' Workload:

Students' workload is distributed as follows:

	Activity	Hrs.	%
Assessment methods and criteria	In-Class Time	56	31%
	Independent Study	81	45%
	Examinations	18	10%
	Group Discussions	14	8%
	Fieldwork and Practicum	11	6%
	Workshops and Seminars	0	0%
	Individual Development	0	0%
Total		**180**	**100%**

Scope and Nature of Assessment Tools

Exams will be closed book/closed notes. Make-up exams are not given except under very special circumstances as stated in New Uzbekistan University bylaws.

Mid-term exam

The Midterm exam is designed to cover all relevant materials covered up to specific time in the semester. The exams might include multiple-choice questions which examine the understanding of different concepts covered in class and simple analytical and problem solving skills. Essay questions may be included to give the opportunity to elaborate different topics. Students are required to reflect on the questions from their understanding. Memorization is to be totally discouraged as it is a futile method in developing critical thinking. Instead, problem solving and critical thinking skills will be emphasized in all *assessment instruments*.

Final exam

The Final exam will be *comprehensive.* It is similar to the mid-term exam in structure; however, it will cover more topics and include more questions. The idea of the final exam is to examine the overall understanding relevant to the Course Learning Outcomes.

Tutorial Activities

Tutorial activity points are earned by being active throughout the tutorials by solving problems at the board. Being inactive or absent negatively affects your participation score. Every student must be at the board at least 3 times during the semester.

Rules to be adhered to:

- Mobile phones must be switched off during class.
- Students cannot leave the class during lecture/tutorial time.
- Students should take responsibility for their own learning.
- Attendance is vitally important to student success. The university policy on class attendance will be strictly implemented.
- Students are expected to do the required readings prior to coming to class.
- Students who are late for more than 10 minutes will be allowed to sit for the class but will be marked as absent in the attendance record.
- In case of absence, students are responsible for the material covered in the missed class.

Approval			
Course instructor / leader			
Name	**Rustam Turdibaev**		
Signature		**Date:**	**January 7, 2025**
Department Head			
Name	**Rustam Turdibaev**		
Signature		**Date**	**January 7, 2025**