**Study program: Information Technology**

**Course title: DISCRETE MATHEMATICS**

**Teachers: Damljanović Ž. Nada**

**Course status: mandatory**

**Number of ECTS credits: 6**

**Prerequisite courses: none**

**Course objectives**

Enabling students to develop abstract and algorithmic thinking using mathematical reasoning and logic, and to acquire fundamental knowledge of combinatorial analysis, discrete structures, graphs, languages, automata, computation, modelling and applications.

**Learning outcomes**

At the end of the course, students would master basic ideas, concepts and results of discrete mathematics, andthey would be able to apply practically their knowledge within the same or within some other scientific fields and subjects.

**Content of the course**

*Theoretical teaching*

Propositional logic: propositional variables, logical constants, logical operations, logical expressions, logical equivalence, tautologies and contradictions, logical argumentation, errors in reasoning. Predicate logic: predicates, quantifiers, logical argument with quantifiers. Techniques of proving: methods of proving, direct and indirect proofs, mistakes in proving, strategy of proving, forward and backward reasoning, mathematical induction, recursive definitions, structural induction. Sets: equality and inclusion, set operations, ordered n- tuples, Cartesian product. Relations: equivalences, partition of sets, ordered sets. Functions: correspondences and functions, bijections, inverse functions, operations, sequences and matrices. Cardinals and counting: set cardinality, finite and infinite sets, countable and uncountable sets, counting principles, permutations, inclusion-exclusion principle. Algebraic structures: groupoids, semigroups, groups, semirings, rings, fields, congruence and factor sets, Boolean algebra, minimization of Boolean functions, binary decision diagrams. Formal languages: operations and combinatorics on words, formal languages, generative grammars, classification of grammars. Automata: Deterministic and nondeterministic automata, minimal language of automata, regular expressions and their applications, automata with outputs, Automata of Mealy and Moore type, equivalent automata, minimization of automata with output. Turing machines: their languages, questions of decidability, computability and complexity. Graphs: planarity, Euler walk, Hamiltonian cycle, and the travelling salesman problem, pairing the bipartite graphs, chromatic number of a graph, trees, direct graphs, labelled graphs.

*Practical teaching*

Solving concrete problems, examples and exercises based on exposed theoretical concepts and principles.

**Literature**

[1] K. H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill Education, 6 edition, 2006.
[2] H. Lewis, R. Zax, Essential Discrete Mathematics for Computer Science, Princeton University Press, 2019.
[3] M. Ćirić, J. Ignjatović, Theory of Algorithms, Languages and Automata, PMF u Nišu, 2012 (in Serbian).
[4] Cvetković, S. Simić, Discrete Mathematics, Prosveta, Niš, 1996 (in Serbian).

| **Number of active teaching classes: 5** | **Theoretical teaching: 2** | **Practical teaching: 3** |
|---|---|---|

**Teaching methods**

The lectures are performed using classical methods of teaching in combination with video projector and active interaction with students. Knowledge of students is tested by homework, colloquium, and final exam (written and oral). At the final, a comprehensive understanding of the exposed material is checked.

**Evaluation of knowledge (maximum number of points 100)**

| **Pre-exam obligations** | **Points** | **Final exam** | **Points** |
|---|---|---|---|
| Student's activity during lectures | 6 | oral examination | 25 |
| Practical classes/tests | 30 | written examination | 35 |
| Seminars/homework | 4 | …… | |