Study programmes: Bachelor studies – Mathematics

Course name: M1.02 Introduction to Mathematical Logic

Lecturers: Goran Đanković, Milan Božić, Zoran Petrović, Dragana Todorić

Status: Compulsory

ECTS: 5

Attendance prerequisites: no prerequisite

Course aims: Acquisition of general and specific knowledge of Mathematical Logic

Course outcome: Upon completion of the course, the students have knowledge of Mathematical Logic. The students understand the following concepts: set, relation, function, countability, proposition, tautology, term, formula, formal systems. The students know fundamental theorems of Set theory and Mathematical Logic. They are able to solve problems in the field, and to attend advanced courses in which the acquired concept and techniques should be applied.

Course content:

Elementary Set Theory. Notion of set; set operations; powerset. Cartesian products; relations; equivalence relations; orderings. The set of natural numbers; the Peano axioms. Functions; images and inverse images; one-to-one (injections) and onto functions (surjections), one-to-one correspondences (bijections). Characteristic functions and set identities. Countable sets (countability of integers and rationals); uncountable sets (uncountability of the reals). Cantor–Bernstein theorem. The axiom of choice and its equivalents.

Propositional logic. Propositions and truth values; propositional connectives; propositional formulas. Boolean algebras, finite Boolean algebras; disjunctive normal form (DNF) and conjunctive normal form (CNF). Complete sets of connectives. Truth assignments; tautologies; verifying tautologies; tautologies versus set identities.

First-order logic. First order language; terms and formulas; free and bound variables. Structures and variable assignments; value of a term, truth value of a formula. Valid first-order formulas; some methods for checking first-order validity (method of semantic tableaux; Skolemization), applications.

Formal systems. Simple examples of formal systems. Formal systems for propositional logic. Completeness and compactness theorems for propositional logic; applications. Formal systems for predicate logic. Completeness and compactness theorems for predicate logic (without proof); applications. Method of analytic tableaux.

Literature:

1. S. Prešić, Elementi matematičke logike, Zavod za udžbenike i nastavna sredstva, Beograd 1983;
2. Ž. Mijajlović, Z. Petrović, Matematička logika, elementi teorije skupova, Beograd, 2012.

Number of hours: 4	**Lectures: 2**	**Tutorials: 2**	**Laboratory: -**	**Research: -**

Teaching and learning methods: Lectures/ Tutorials

Assessment (maximal 100 points)

Course assignments	**points**	**Final exam**	**points**
Lectures	-	Written exam	30
Exercises / Tutorials	-	Oral exam	40
Colloquia	30	Written-oral exam	-
Essay / Project	-		