**Course:** Computability theory

Course instructors: Silvia Ghilezan, Zoran Ognjanović

**Course type:** elective

**Credit points ECTS:** 12

### **Prerequisites:**

**Course objectives:** 

Introduction to the basic ideas, concepts and results of the theory of computability and complexity of computation, as well as practical applications in the analysis of formalized problems.

## Learning outcomes:

At the end of the course, the student will get acquainted with the basic ideas, concepts and results of computability and complexity of computations, and will be able to independently apply these ideas, concepts and results in scientific research within the same or some other scientific field.

# **Course description (outline):**

Theoretical classes

Basic concepts: coding, recursive functions, Turing machines, equivalence of various formal computational systems, Church thesis.

Computability: Kleenenormal form theorem, decidability, recursively enumerable sets, s-m-n theorem, recursion theorem, relative computability.

Godel's incompleteness theorem: representation of recursive functions and relations in PA, Chinese residual theorem, first and second Godel incompleteness theorems, nondecidability of arithmetic.

Arithmetic hierarchy: the halting problem, jumps, basic definitions and theorems.

Complexity theory: basic definitions, complexity classes, complete problems, probability complexity classes, protocols.

# Practice classes

#### **References:**

5. Christos H. Papadimitriou, Harry Lewis, Elements of the theory of computation, Prentice-Hall, 1997.

6. Christos H. Papadimitriou, Computational Complexity, Addison Wesley, 1994.

7. Zoran Ognjanović, Nenad Krdžavac, Uvod u teorijsko računarstvo, FON, Beograd, 2004.

Active teaching hours: 5 Theoretical classes: 5 Practice classes:

### Methods of teaching:

Classical teaching methods with video projectors and interaction with students. Students' knowledge is tested through homework and defense of seminar papers. The final oral exam checks the comprehensive understanding of the presented material.

### Grading structure (100 points)

Pre-exam obligations:

• activity during classes 10 points,

• seminar paper or oral seminar 30 points,

Oral exam 60 points