UNIVERSITY
OF WARMIA AND MAZURY
IN OLSZTYN

Faculty of Mathematics and Computer Science

Course title FOUNDATIONS OF CALCULABILITY THEORY

ECTS credit allocation (and other scores): 3,5

Semester: spring

Level of study: ISCED-6 - first-cycle programmes (EQF-6)

Branch of science: Natural sciences

Language: English

Number of hours per semester: 30 lectures + 30 classes = 30 hours

Course coordinator/ Department and e-mail: Erasmus coordinator Anna Szczepkowska/ WMiI, erasmuswmii.uwm.edu.pl

Type of classes: classes and lectures

Substantive content

CLASSES:

The discussion of the computer's model. Programs with procedures. A survey on basic general recursive funtions. Kleen's formality. Encoding finite subsets of the set of natural numbers. Recursively countable sets. Application of the s-m-n theorem in order to prove the existence of general recursive function with prescribed properties. The application of the projection theorem to prove that a given set is recursively countable. Proving that a given operator is a recursive operator.

LECTURES:

Formalisation of the concept of computability. The Church's thesis. Effective numerations of programs and numeration of classes of partial recursive functions induced by them. Theorem on universal function and s-m-n - theorem. Recursive sets, the Rice's theorem and examples of undecidable problems. Recurively enumerable sets, m-reducibility, the Rice-Shapiro theorem. The tenth Hilbert's problem. Recursive oprators. The first Kleene Recursion Theorem and its applications to define a semantics of recursive procedures. The Second Kleene Recursion Theorem.

LEARNING PURPOSE:

Introduction to problems and methods of recursion theory which nowadays is considered as a meta computer science. Analysis of possibilities and bounds of computer science. Strengthening the understanding of the computability phenomena. Problems already mentioned have strong influence on so called informatic culture of students.

On completion of the study programme the graduate will gain:

Knowledge:

One knows one of many equivalent formalisations of the concepts of computability
One has a general idea of encoding concept of complex structures given with natural numbers which is due to Kurt Godle
One is aware of bounds of computer science, knows basic examples of undecidable problems
One is aware that by the usage of computer sciences' methods it is possible to separate interesting classes of natural numbers' subsets
One knows the concept of recursive operator

Skills:

One has the ability of programming in a simple theoretc programming language
One is able to use in practise two fundamental theorems of recurion: the theorem on universal function and the s-m-n-theorem
One is able to show in concrete simple situations that a a given subset of natural numbers is or is not recursively counable [recursive]
One is able to explain that a given operator is a recursive operator

Social competence:

One knows the limits of its own knowledge and understands the need of additional learning
One estimates the meaning of mathematics in precise formulating and solving problems connected with basis of computer science
One is aware that studying every science (on the academic level) is strictly connected with getting elementary knowledge of its metatheory.

Basic literature:

Cutland N., , "Computability. An Introduction to Recursive Function Theory", wyd. Cambridge University Press., 1980