Course Unit Descriptor

Study Programme: Information Technology

Course Unit Title: Soft Computing

Course Unit Code: OAS059

Name of Lecturer(s): Associate Professor Vladimir Brtka, PhD

Type and Level of Studies: Bachelor Academic Degree

Course Status (compulsory/elective): Compulsory

Semester (winter/summer): Summer

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 6

Prerequisites: None

Course Aims:

Course aims are introduction to Soft Computing concepts as modern trends of development of the theory and application of fuzzy sets, fuzzy logic, artificial neural networks, hybrid neuro-fuzzy systems, genetic algorithms, probabilistic computing, and other techniques of soft computing. This will expand and complement the knowledge gained by studying the subjects of logic and artificial intelligence. Soft Computing as a domain of Computational Intelligence is of great importance for IT engineers who need to learn through practice in an adequate theoretical and conceptual framework.

Learning Outcomes:

Students are trained to understand theoretical and practical basis of fuzzy sets and fuzzy logic and deepen their knowledge in the field of fuzzy logic applications. Also, students are prepared to develop and apply fuzzy logic based controllers in various domains, especially in domains of IT, engineering and computer science. Furthermore, students are trained in development of artificial neural networks and their applications, as well as some other techniques such as rough sets and genetic algorithms.

Syllabus:

Theory

The theory of fuzzy sets. Imprecision, and vagueness. Relation to classical logic and probability. Operations on fuzzy sets. Linguistic (fuzzy) variables. Linguistic modifiers. Fuzzy numbers. Logical measures (norms and co-norms). Fuzzy relations. Fuzzy logic, methods of fuzzy inference. Fuzzy control. Development and structure of fuzzy controller. Examples of application of fuzzy logic in databases, decision-making, engineering and medicine. Neural networks - a model of natural and artificial neurons. Types of Artificial Neural Networks (ANN). Training of ANN. Fuzzy neuron. Examples of application. Hybrid (fuzzy - neuro) systems. Probabilistic and evolutionary computing. Rough sets.

Practice

Implementation and application of fuzzy logic controllers and ANNs in Java or C#. Implementation and application of fuzzy logic controllers and ANNs in Matlab or GNU Octave. Python numpy, pandas and matplotlib libraries and their capabilities. Google Tensorflow and Jupyter lab. Rough sets Rosetta and RSES software applications.

Required Reading:

1. Vladimir Brtka, "Soft Computing", Technical faculty "Mihajlo Pupin", Zrenjanin, 2013.
2. Engelbrecht Andreas, "Computational Intelligence, An Introduction", John Wiley & Sons, Ltd, England 2002.

Weekly Contact Hours: 4	**Lectures:** 2	**Practical work:**2

Teaching Methods: Lectures and students group work			
Knowledge Assessment (maximum of 100 points): 100			
Pre-exam obligations	points	**Final exam**	points
Active class participation	20	written exam	30
Test I and Test II	50	oral exam	