Course title: Computational Intelligence	**Neptun code: GEIAK432-a**
Course coordinator: Dr. Olivér Hornyák, PhD, associate professor	
type of lesson and number of lessons: **lecture (2)**	
method of evaluation: colloquium	
curriculum location of the subject: (autumn/spring semester): autumn and spring	
pre-study conditions *(if any)*: -	
The task and purpose of the subject:	
Objectives: The objective of this course is to provide comprehensive knowledge about the principles and techniques of Soft Computing, including fuzzy logic, genetic algorithms, and hybrid systems. Students will learn the theoretical foundations, mathematical background, and practical applications of these methods in various areas of machine intelligence research. The course will cover the development and applications of fuzzy systems, genetic algorithms, and the integration of these techniques into hybrid systems. Goals: The goal of the course is to equip students with a deep understanding of Soft Computing methods and their application to complex problem-solving. Emphasis will be placed on the integration of fuzzy systems and genetic algorithms, as well as the development and application of hybrid systems. Additionally, the course aims to provide students with insights into the role and significance of these techniques in machine intelligence research, preparing them for further research and practical work in the field.	
Course description:	
The concept of Soft Computing, its historical background, and its place and role in machine intelligence research. The concept of fuzzy logic and fuzzy sets. Operations with fuzzy sets, aggregation operators. Approximate reasoning procedures. Structure of fuzzy control systems. Applications of fuzzy systems. Basics and applications of genetic algorithms. The concept and types of hybrid systems. Fuzzy-neuro, fuzzy-genetic, neuro-genetic, and fuzzy-neuro-genetic systems. Applications of hybrid systems. Neural networks	
Required literature:	
1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani: Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, Pearson, 2012, ISBN: 978-8120344972 2. Timothy J. Ross: Fuzzy Logic with Engineering Applications (4th Edition), Wiley, 2016, ISBN: 978-1119235866 3. Simon Haykin: Neural Networks and Learning Machines (3rd Edition), Kiadó: Pearson, 2008, ISBN: 978-0131471399 4. A.E. Eiben, J.E. Smith: Introduction to Evolutionary Computing (2nd Edition), Springer, 2015, ISBN: 978-3662448731 5. David E. Goldberg: Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 2013 (utánnyomás), ISBN: 978-0201157673	

Recommended literature:

1. Richard O. Duda, Peter E. Hart, David G. Stork: Pattern Classification (2nd Edition)
2. S.N. Sivanandam, S.N. Deepa: Principles of Soft Computing (2nd Edition)
3. Stuart Russell, Peter Norvig: Artificial Intelligence: A Modern Approach (4th Edition)