AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Genetic and evolutionary algorithms in engineering

Academic year: 2013/2014 Code: RMS-1-609-s ECTS credits: 3

Faculty of: Mechanical Engineering and Robotics

Field of study: Mechatronics with English as instruction languagege Specialty: —

Study level: First-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 6

Course homepage: —

Responsible teacher: dr inż. Gibiec Mariusz (mgi@agh.edu.pl)

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Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence			
M_K001	awareness of the responsibility for own work and readiness to comply with the rules of team work and accepting responsibility for tasks performed collectively	MS1A_K04	Execution of laboratory classes
Skills			
M_U001	ability to assess the type of the mechatronic problem and to choose the aproppiate artificial intelligence method for solving it	MS1A_U10, MS1A_U12	Execution of laboratory classes, Test results
M_U002	ability to formulate the mechatronic problem and to design and build the artificial intelligence tool that solves it.	MS1A_U14, MS1A_U10, MS1A_U12, MS1A_U08	Execution of laboratory classes, Test results
M_U003	ability to code properly input data and to adjust parameters of artificial intelligence methods for solving problems of optimization, classification and pattern recognition and to aid the designing process with the use of these methods	MS1A_U12, MS1A_U08	
Knowledge			

M_W001	knowledge of the methods and techniques of the artificial intelligence and the background of their formulation; knowledge of their utilisation for the engineering problems solving	MS1A_W12	Execution of laboratory classes, Test results
M_W002	knowledge and understanding of methodology of the artificial intelligence systems applications for the purposes of designing and building mechatronic devices; knowledge of computer tools for the design and simulation of artificial intelligent systems	MS1A_W12	Execution of laboratory classes, Test results

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Others	Fieldwork classes	Workshops	E-learning
Social competence												
M_K001	awareness of the responsibility for own work and readiness to comply with the rules of team work and accepting responsibility for tasks performed collectively	-	-	+	-	-	-	-	-	-	-	-
Skills												
M_U001	ability to assess the type of the mechatronic problem and to choose the aproppiate artificial intelligence method for solving it	+	-	+	-	-	-	-	-	-	-	-
M_U002	ability to formulate the mechatronic problem and to design and build the artificial intelligence tool that solves it.	+	-	+	-	-	-	-	-	-	-	-
M_U003	ability to code properly input data and to adjust parameters of artificial intelligence methods for solving problems of optimization, classification and pattern recognition and to aid the designing process with the use of these methods	+	-	+	-	-	-	-	-	-	-	-
Knowledge												

M_W001	knowledge of the methods and techniques of the artificial intelligence and the background of their formulation; knowledge of their utilisation for the engineering problems solving	+	-	-	-	-	-	-	-	-	-	-
M_W002	knowledge and understanding of methodology of the artificial intelligence systems applications for the purposes of designing and building mechatronic devices; knowledge of computer tools for the design and simulation of artificial intelligent systems	+	-	-	-	-	-	-	-	-	-	-

Module content

Lectures

1. Introduction to the artificial intelligence methods
2. Genetic Algorithms – theoretical bases
3. A Survey of Genetic Algorithms Applied to Academic and Industrial Test Cases
4. Using Genetic Algorithms for Optimization
5. Genetic optimization of designing process
6. Evolutionary Algorithms – theoretical bases
7. A Survey of Evolutionary Algorithms Applied to Academic and Industrial Test Cases
8. Genetic and Evolutionary Algorithms Application to Artificial Neural Networks Development

Laboratory classes

An Introduction to Genetic and Evolutionary Computation – a software survey
Three Elements of Representations for Genetic and Evolutionary Algorithms
Analysis and Design of Representations for Trees.
Using Genetic Algorithms for Optimization
Genetic Algorithms for the Traveling Salesman Problem
Generator Scheduling in Power Systems by Genetic Algorithm
Genetic Algorithm as a Tool for Solving Electrical Engineering Problems
Genetic Algorithms in Shape Optimization
Evolutionary Approaches to Clustering
Partitioning 3-D Unstructured Grids Using Evolutionary Algorithms
Genetic and Evolutionary Algorithms Application to Artificial Neural Networks Development

Method of calculating the final grade

Weighted sum of mark from the test and marks from laboratory reports

Prerequisites and additional requirements

Prerequisites and additional requirements not specified

Recommended literature and teaching resources

Genetic algorithms in engineering and computer science / ed. by G. Winter [et al.].
Genetic algorithms in search, optimization, and machine learning / David E. Goldberg.
Genetic algorithms in optimisation, simulation and modelling / ed. by J. Stender, E. Hillebrand and J. Kingdon.
Evolutionary algorithms for single and multicriteria design optimization / Andrzej Osyczka.

Scientific publications of module course instructors related to the topic of the module

Additional scientific publications not specified

Additional information

None

Student workload (ECTS credits balance)

Student activity form	Student workload
Examination or Final test	1 h
Realization of independently performed tasks	15 h
Preparation of a report, presentation, written work, etc.	14 h
Participation in laboratory classes	30 h
Participation in lectures	15 h
Preparation for classes	5 h
Summary student workload	80 h
Module ECTS credits	3 ECTS