ALGORITHMICS - SELECTED ISSUES

Faculty of Computer Science				
Study programme:	**Computer Science**		Degree level:	**Engineer's degree full-time programme**
Specialization	**---**		Diploma path:	**2026/2027W - 2026/2027S**
Module name:	**Algorithmics - Selected Issues** (Algorytmika - wybrane zagadnienia)			
Module type:	**obligatory**	**Semester: 2**	ECTS:**5**	Module ID:**FCS-00098**
No. of hrs in semester:	Lecture (L) - **26** Classes(C) - **0** Specialization workshop (SW) - **30** Project (P) - **0** Laboratory classes (LC) - **0** Seminar (S) - **0**			
Prerequisites	Algorithms and Data Structures (FCS-00020),			

Aims and objectives:	The aim of the course is to develop the ability to construct a graph or network model for real problems. The student will be learn: methods of determining the shortest paths in graphs, methods of designing effective solutions for networ flow problems , methods of constructing effective heuristics for computationally difficult graph problems. The student will develop the skills of: designing computationally effective algorithms and data structures for graph problems, assessing the effectiveness of applied solutions, identifying computationally difficult problems and using approximate solutions for these problems. The aim of the course is also to develop the ability to communicate effectively in the field of engineering and scientific problems with representatives of other branch of life.		
Forms of teching activities::	lecture, specialization workshop,	Assessment:	Evaluation must be relevant to the intended learning outcomes:
			Lecture- test specialist workshop- projects
Module content:	Lecture: Graph browsing algorithms. BFS and DFS methods and their applications. Effective path algorithms for graphs with weights. Strategies: label-setting and label-corecting. The problem of maximum flow in the network and effective methods of its determination. The problem of the cheapest flow in the network - effective algorithms and examples of application. Graph and network problems difficult to solve. Examples of approximate solutions for graph problems of the NPC class. The traveling salesman problem and its variants. Examples of applications of various types of traveling salesman problems in information systems in the field of logistics and e-tourism class systems. Effective aprokysmation algorithms for different varieties of the traveling salesman problem. The problem of routing in transport networks. Specialist workshop: A problem task that requires the development of an algorithm based on BFS and DFS graph searching methods A problem task that requires the development of an algorithm based on the use of path algorithms A problem task that requires the development of an algorithm based on the use of networkflow algorithms A problem task that requires the development of an algorithm based on the use of approximation algorithms.		
Teaching methods:	programming, lecture problem,		

Learning outcomes

Symbol	Specify min. 4, max. 8 learning outcomes in the following order: knowledge – skills – competence. Each learning outcome must be verifiable	Reference to the programme learning outcomes of education
LO1	knows and understands the concepts related to algorithmics in the field of graph and network issues	INF1_W05
LO2	knows and understands the operation of standard methods of designing effective graph and network algorithms	INF1_W05
LO3	student can build a graph or network model for a problem formulated with the language of practice	INF1_W05 INF1_U13
LO4	student can design effective solutions for an identified graph or network problem and describe them using nomenclature and concepts appearing in the created model	INF1_U04
LO5	student can assess the quality of proposed solutions, carry out their correctness and computational complexity tests	INF1_U04 INF1_U14

No. of learning outcome	Methods of assessing the learning outcome	Type of teaching activities (if more than one) during which the outcome is assessed
LO1	test-lecture,	L
LO2	test	L
LO3	test-lecture programs- specialists workshop	L, Sw
LO4	programs on specialist workshop	Sw
LO5	programs on specialist workshop	Sw

Student's workload (in hours)	**1** - participation in the lecture	13x2h	26
	2 - participation in the specialist workshop	15x2h	30
	3 - preparation to the he specialist workshop	None	24
	4 - Implementation of problem tasks of the specialist workshop	None	20
	5 - Participation in consultations	None	5
	6 - Preparation for completing the course	None	20
		TOTAL:	**125**

Quantitative indicators	Student's workload - activities that require direct teacher participation: (2)+(1)+(5)	61	**ECTS** 2.4
	Student's workload connected with practical classes (2)+(4)+(3)+(5)	79	3.2
Basic references:	1. Ravindra K Ahuja Thomas L Magnanti; James B Orlin- Network flows : theory, algorithms, and applications 1993 2. T. H. Cormen, Introduction to algorithms, 3.Nacima Labadie, Christian Prins, and Caroline Prodhon- Metaheuristics for Vehicle Routing Problems, 2016		
Further reading	1.Ravindra K Ahuja Thomas L Magnanti; James B Orlin- Network flows : theory, algorithms, and applications		
Unit:	Department of Theoretical Computer Science	Lecturer/ instructor	dr Joanna Karbowska-Chilińska,dr inż. Krzysztof Ostrowski
Date of issuing the programme:	26th March 2026	Author of the programme:	dr Joanna Karbowska-Chilińska

L - lecture, C - classes, LC - laboratory classes, P-project, SW - specialization workshop, S - seminar