STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Algorithms and Complexity		**1010331511010334958**
Field of study	Profile of study (general academic, practical)	Year /Semester
Information Engineering	**(brak)**	**1 / 1**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**
Cycle of study:	Form of study (full-time,part-time)	
First-cycle studies	**full-time**	
No. of hours		No. of credits
Lecture: **30** Classes: **15** Laboratory: **15** Project/seminars: **-**		**6**
Status of the course in the study program (Basic, major, other)	(university-wide, from another field)	
(brak)	**(brak)**	
Education areas and fields of science and art		ECTS distribution (number and %)
technical sciences		**6 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student has a basic knowledge of high school programme.
2	**Skills**	Student is able to meet the challenges arising from the high school.
3	**Social competencies**	Student has competences resulting from the high school.

Assumptions and objectives of the course:

The aim of the course is to teach students the methods of constructing algorithms using basic techniques, taking into consideration the analysis of computational complexity.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student has an ordered and well-based in theory, knowledge of basic algorithms and their analysis, design techniques, abstract data structures and their implementation, computationally difficult problems. - [[K_W04]]

Skills:

1. Student is able to construct algorithms using basic algorithmic techniques and analyse their complexity. - [[K_U09]]
2. Student is able to evaluate the usefulness of routine methods and tools for solving simple tasks typical of engineering informatics and select and apply appropriate technologies. - [[K_U22]]

Social competencies:

1. Student is aware of the importance of a thorough implementation of the project, to preserve, respect for linguistic correctness standards and timely delivery of work. - [[K_K07]]

Assessment methods of study outcomes

Written examination based on lecture, laboratory participation, classes presentation.

Course description

Problem, algorithm, time and space computational complexities; decision problem, optimization problem. Design of efficient algorithms: data structures (lists, stacks, queues, priority queues), set representations (list, bit vector, array), graph representations (adjacency matrix, adjacency list), binary tree, preorder, postorder and inorder, recursion, 'divide and conquer', balancing, dynamic programming, greedy algorithm, heuristics. Sorting: ordering in a set of elements and sorting, bubble sort, lexicographic sort, sorting by comparisons, heapsort, quicksort. Searching, selection. Data structures for set manipulation problems: fundamental operations on sets, dictionaries, hashing, binary search, binary search tree. Algorithms on graphs: minimum-cost spanning trees, biconnectivity, strong connectivity. Matrix multiplication and related operations. Integer arithmetic. Polynomial hierarchy: models of computation, P and NP classes, NP-complete problems. Nondecidable problems.

Classes deal with assigning algorithms working on Turing machines and Random Access Machines with respect to their complexity.

In the laboratory student tests already written and its own algorithms corresponding to field of the lecture. Student also improve its skills in the area of designing data structures, algorithms and the analysis of the complexity.

Basic bibliography:

1. (The design and Analysis of Computer Algorithms, Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Addison-Wesley, Reading, MA, 1976.

Additional bibliography:

1. The Art of Computer Programming, D.E. Knuth, Addison-Wesley, Reading, MA, 1997.

Result of average student's workload

Activity	Time (working hours)
1. Lecture	30
2. Classes	20
3. Laboratory	20
4. Preparation to classes and laboratory	30
5. Preparation to tests	20
6. Preparation to the examination	20
7. Participation in tests and examination	10

Student's workload

Source of workload	hours	ECTS
Total workload	150	6
Contact hours	80	3
Practical activities	50	2