COURSE DESCRIPTION CARD - SYLLABUS

Course name
Operational Research [N1Inf1>BOP]

Course

Field of study
Computing

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
16

Laboratory classes
0

Other
0

Tutorials
16

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

The student starting this course should have basic knowledge of linear algebra, mathematical analysis, and computational complexity theory. He should have the ability to perform basic operations on matrices, calculate derivatives, find the extreme of a function, determine the computational complexity of problems and algorithms, and the ability to obtain information from indicated sources. They should also understand the need to expand their competences and be ready to cooperate within the team. Moreover, in terms of social competences, the student must present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. Provide students with basic knowledge of operations research in the field of optimization problems and methods as well as deterministic scheduling problems. 2. Developing students" ability to model decision situations and solve simple problems of continuous and combinatorial optimization. 3. Shaping students" teamwork skills in the field of decision-making analysis.

Course-related learning outcomes

Knowledge:

1. has extended and in-depth knowledge of mathematics useful for formulating complex IT tasks written in the form of mathematical programming problems (linear and non-linear) or network programming and solving them with selected optimization methods
2. has ordered and theoretically founded general knowledge in the field of key IT issues, and detailed knowledge of task scheduling methods

Skills:
1. is able to properly plan and perform computational experiments and interpret the results obtained, and correctly draw conclusions from them
2. can, when formulating and solving IT tasks, apply appropriately selected methods, including analytical or experimental methods
3. can assess the computational complexity of algorithms and problems

Social competences:
1. understands that in computer science knowledge and skills very quickly become obsolete
2. is aware of the importance of knowledge in solving engineering problems and knows examples of applications of operational research tools to solve various practical problems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Formative assessment - in the scope of lectures: on the basis of answers to questions concerning the material discussed in previous lectures; in terms of exercises: on the basis of the assessment of the current progress in the implementation of tasks.
Summative assessment: continuous assessment, during each class (oral answers, solving tasks at the blackboard) - rewarding the increase in the ability to use the known methods (optional: assessment of knowledge and skills related to solving tasks independently during a maximum of one test per semester), knowledge assessment and skills demonstrated on the written exam in the form of a test containing closed questions, questions checking the ability to use the available software implementing the simplex algorithm and open tasks requiring solutions to simple optimization tasks; half of the maximum number of points is required to pass the exam; the grade for the auditorium exercises is determined by the tutor on the basis of the exam grade corrected by the student"s activity grade (recorded on a regular basis) during the tutorial classes.
Obtaining additional points for activity during classes, especially for: discussing additional aspects of the issue, the effectiveness of applying the acquired knowledge when solving a given problem, comments related to the improvement of teaching materials, indicating students" perceptual difficulties enabling ongoing improvement of the teaching process.

Programme content

Lecture: The subject of operations research. Construction and classification of decision models. Linear programming: problem formulation and computational complexity, graphical method, simplex method. Nonlinear programming: Lagrange and Karush-Kuhn-Tucker conditions, selected numerical methods. Integer programming: the Gomory cutoff method. Selected metaheuristic algorithms. Deterministic problems of scheduling tasks: basic assumptions and their interpretation, exemplary approaches and algorithms. Selected problems and methods of activity network analysis: CPM method, PERT method, CPM-MCX method.
Classes: Building decision models. Solving linear programming problems using the graphical and simplex method. Finding an initial solution to the underlying PL problem using an artificial base method. Interpretation of the solution of the problem PL. Analytical methods of solving nonlinear programming problems: Lagrange"s method and KKT method. Gomory cut-off method. CPM method.
Some of the above-mentioned program content is carried out as part of the student"s own work.

Course topics

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Teaching methods

Lecture: multimedia presentation illustrated with examples given on the board, solving example tasks.
Exercises: problem solving, discussion, group work, exercises with the use of computer educational programs

Bibliography

Basic
1. Handbook on Scheduling : From Theory to Applications, Błażewicz J.i inni, Springer, Berlin, 2007
2. Introduction to Operations Research, Hillier F. S., Lieberman G. J., McGraw-Hill, New York, 1990
3. Badania operacyjne i teoria optymalizacji, J. Józefowska, Wyd. Politechniki Poznańskiej 2012.
4. Badania operacyjne, Ignasiak E.(red.), PWE, Warszawa, 1996
5. Badania operacyjne w przykładach i zadaniach, Jędrzejczak Z., Skrzypek J., Kukuła K., Walkost Anna, PWN, Wyd. IV zmienione, Warszawa, 2002
Additional
1. J.G. Ecker, M. Kupferschmid. Introduction to Operations Research. John Wiley & Sons, New York, 1988.
2. M. Siudak. Badania operacyjne. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 1994.
3. P. D. Straffin. Teoria Gier. WN Scholar, Warszawa, 2001.
4. T. Trzaskalik. Wprowadzenie do badań operacyjnych z komputerem. Polskie Wydawnictwo Ekonomiczne, Warszawa, 2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	34	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	66	2,50