COURSE DESCRIPTION CARD - SYLLABUS

Course name
Optimization models and tools for management infomation systems [N2Inf1-IWPB>MNOPT]

Course

Field of study
Computing

Year/Semester
1/2

Area of study (specialization)
Information Technology in Business Processes

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
16

Laboratory classes
18

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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Prerequisites

Student starting this course should have a basic understanding of mathematics and the basics of operations research. Should have the ability to solve complex equation systems as well as efficiently use the existing software supporting calculations. Should be able to obtain information from the indicated sources. She/he should also understand the need to expand their competences and be ready to cooperate within the team. In addition, in terms of social competences, the student must present attitudes such as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. Provide students with extended knowledge of operational research and mathematical programming in the field useful in business applications 2. Developing students" skills in modeling decision situations, selecting appropriate tools of operational research and solving formulated optimization problems with their use. 3. Shaping in students the ability to critically analyze the results obtained with numerical methods

Course-related learning outcomes

Knowledge:

1. has advanced and in-depth knowledge of widely understood IT systems, including optimization of the use of computer resources
2.has ordered and theoretically founded general knowledge related to key issues in the field of computer science, including the theory of computational complexity
3.has advanced detailed knowledge of selected issues in the field of computer science, such as heuristic methods for determining solutions to optimization problems
4. knows advanced methods, techniques and tools used to solve complex engineering tasks, in particular approaches based on the methods of mathematical programming

Skills:
1.can obtain information from literature, databases and other sources (in Polish and English), integrate them, make their interpretation and critical evaluation, draw conclusions and formulate and exhaustively justify opinions
2. can use analytical and numerical methods to formulate and solve engineering tasks and simple research problems
3.can - when formulating and solving engineering tasks - integrate knowledge from various areas of computer science (as well as knowledge of the organization of production processes) and apply a system approach, also taking into account non-technical aspects
4. is able to properly plan and perform computational experiments and interpret the results obtained, and correctly draw conclusions from them
5. can assess the computational complexity of algorithms and problems

Social competences:
1. understands the importance of using the latest knowledge in the field of computer science in solving research and practical problems
2. understands the importance of popularizing the latest achievements in the field of computer science, in particular the benefits of using optimization methods
3. is aware of the need to develop professional achievements and observe the rules of professional ethics, in particular by disseminating knowledge about the limitations of the approaches used

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Formative assessment - in the field of lectures: on the basis of answers to questions about the material discussed in previous lectures. For laboratories: based on the assessment of the implementation of individual tasks
Summative assessment - in the field of lectures: by assessing the knowledge and skills shown in the exam in the form of a test, which consists of several dozen closed and open problem-related questions. To pass the exam, it is necessary to obtain at least half of the possible number of points. In the field of laboratories: assessment of the implementation of problem tasks carried out in classes and summarized in the form of a report during the student"s own 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 didactic materials, indicating students" perceptual difficulties enabling ongoing improvement of the didactic process

Programme content

Lecture: General formulation of optimization issues in business processes. Examples of linear and nonlinear problems in mathematical programming. Classification of problems in mathematical programming. Basic methods of solving problems of linear mathematical programming (graphical method, simplex method) and non-linear (Lagrange"s method, KKT method). Selected methods of solving integer linear problems (method of cutting planes). Practical use of selected methods of numerical determination of solutions to nonlinear problems in mathematical programming. Selected programming tools for solving linear and nonlinear programming problems. Methods of time and time-cost analysis for project scheduling. Metaheuristic methods of solving optimization problems (simulated annealing, tabu search, genetic and evolutionary algorithms).
Laboratories: Examples of real decision problems and their modeling in the form of mathematical programming problems. Selection of the right programming tools to solve the appropriate optimization

problems. Practical use of available linear and nonlinear solvers. Selected problems and methods of activity network analysis: CPM method, CPM / MCX method. Examples of practical use of metaheuristic methods in business.
Some of the above-mentioned program content is carried out as part of the student"s own work.

Teaching methods

Lecture: multimedia presentation illustrated with examples given on the board, solving example tasks, demonstration of available tools, materials available on the university"s Moodle platform.
Laboratories: modeling, formulating and solving problems on the blackboard, using available solvers

Bibliography

Basic
1. Anderson D. R., Sweeney D. J., Williams T. A., Quantitative Methods for Business, South-Western College Publishing, 2000.
2. Badania operacyjne, red. E. Ignasiak, PWE, Warszawa 1997.
3. Siudak M., Badania operacyjne, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1994
4. Błażewicz J., Cellary W., Słowiński R., Węglarz J., Badania operacyjne dla informatyków, skrypt Politechniki Poznańskiej 1137, Wydawnictwo Politechniki Poznańskiej, Poznań 1984.
5. Jędrzejczyk Z., Kukuła K., Skrzypek J., Walkosz A., Badania operacyjne w przykładach i zadaniach, red. K. Kukuła, Pracownia Poligraficzna Akademii Ekonomicznej w Krakowie, Kraków 1992
Additional
1. Algorytm ewolucyjny i jego zastosowanie w optymalizacji rozdziału zasobów ciągłych i dyskretnych, Różycki R., Zarządzanie i technologie informacyjne. Tom 2. Metody sztucznej inteligencji w zarządzaniu i sterowaniu, Józefowska J.(red.), roz.12, Wydawnictwo Uniwersytetu Śląskiego, Katowice 2005.
2. Wykorzystanie systemów informacji geograficznej w biznesie, Różycki R., Sroczan M., Inteligentne systemy w inżynierii i ochronie środowiska, praca zbiorowa, Futura, Poznań 2007, s.143 153.
3. Wybrane zagadnienia społecznej odpowiedzialności biznesu w branży IT, Różycki R., Zdeb S., Zaopatrzenie w wodę, jakość i ochrona wód, Tom I, Sozański M. (red.), PZITS, Poznań 2012, s.377-396.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	36	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	89	3,50