COURSE DESCRIPTION

Course code	full-time studies	
	part-time-studies	
Course name	**Badania Operacyjne**	
Course name in English	**Operations Research**	
Valid from academic year	**2022/23**	

PLACEMENT IN THE TEACHING PROGRAM

Field of study	**Computer Science**
Level of education	**1ˢᵗ degree**
Studies profile	**General**
Form and method of teaching classes	**Full-time and part-time studies**
Specialization	**All specializations**
Organizational unit responsible for the course	**Katedra Informatyki Stosowanej**
Course coordinator	**Dr inż. Jarosław Wikarek**
Approved by	**Dean of the Faculty of Electrical Engineering, Automatic Control and Computer Science Roman Deniziak, KUT prof., DSc, PhD**

GENERAL CHARACTERISTIC OF THE COURSE

Course affiliation		**General education subject**
Course status		**elective subject**
Language		**English**
Semester	full-time studies	**Semester VII**
	part-time-studies	**Semester VIII**
Requirements		
Exam (YES/NO)		**NO**
ECTS		**6**

Course form		lecture	classes	laboratory	project	other
Hours per semester	full-time studies	**30**		**15**	**30**	
	part-time-studies	**18**		**9**	**18**	

LEARNING RESULTS

Category	Result Symbol	Learning Results	References to the field of study results
Knowledge	W01	Knows the basic concepts related to the subject of operations research.	INF_W16
	W02	Has knowledge about the formalization of decision problems.	INF_W16
	W03	Knows and understands the principles of algorithms and methods of solving decision-making problems.	INF_W16
	W04	Knows various methods of evaluating the obtained solution.	INF_W16
Skills	U01	Can develop a mathematical model of any decision problem.	INF_U16
	U02	Can use methods and algorithms to solve a specific decision problem.	INF_U16
	U03	Is able to evaluate the received solutions. Perform a sensitivity analysis of the obtained results.	INF_U16
Social competence	K01	Knows how to prioritize activities.	INF_K1
	K02	He is ready to work in a team, solve tasks together.	INF_K2

COURSE CONTENT

Course Form	Content
lecture	1. Formalization of decision problems. 2. Selected algorithms for solving discrete optimization problems: linear programming, linear integer programming, 0-1 programming, dynamic programming, traveling salesman problem, flows in networks. 3. Decisions under uncertain conditions. 4. Scheduling tasks. 5. The problem of queues. 6. Multi-criteria programming. 1. 7. Constraint logic programming.
laboratory	1. Discrete optimization packages. 2. Modeling of selected discrete optimization problems. 3. Sensitivity analysis of the obtained solutions. 4. Constraint logic programming.
project	Students perform tasks in a multi-person team. Its subject is to develop a computer application to solve a selected problem of discrete optimization

LEARNING RESULTS VERIFICATION METHODS

Result Symbol	Learning results verification methods					
	Oral Exam	Written Exam	Midterm	Project	Report	Other
W01			X	X	X	
W02			X	X	X	
W03			X	X	X	
W04			X	X	X	
U01				X	X	
U02				X	X	
U03				X	X	

				X	X	
K01				X	X	
K02				X	X	

ASSESSMENT FORMS AND CRITERIA

Course Form	Assessment Form	Assessment Criteria
lecture	pass with a grade	Obtaining at least 50% of the points in the written test
laboratory	pass with a grade	Average grade for completing tasks in class and reports.
project	pass with a grade	Obtaining at least 50% points for the developed software, its documentation and defense of the project.

STUDENT'S VOLUME OF WORK

<table>
<tr><th colspan="9">ECTS Balance</th></tr>
<tr><th rowspan="3">No.</th><th rowspan="3">Activity Type</th><th colspan="10">Student Involvement</th><th>Unit</th></tr>
<tr><th colspan="5">full-time studies</th><th colspan="5">part-time-studies</th><th></th></tr>
<tr><th>Lec</th><th>C</th><th>Lab</th><th>P</th><th>S</th><th>Lec</th><th>C</th><th>Lab</th><th>P</th><th>S</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Participation in classes according to the schedule</td><td>30</td><td></td><td>15</td><td>30</td><td></td><td>18</td><td></td><td>9</td><td>18</td><td></td><td rowspan="2">h</td></tr>
<tr><td colspan="11"></td></tr>
<tr><td>2.</td><td>Other (consultations, exams)</td><td>2</td><td></td><td>2</td><td>1</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td></td><td>h</td></tr>
<tr><td>3.</td><td>Total with the direct assist of an academic teacher</td><td colspan="5">80</td><td colspan="5">48</td><td>h</td></tr>
<tr><td>4.</td><td>Number of ECTS, that students obtains with the direct assist of an academic teacher</td><td colspan="5">3,20</td><td colspan="5">1,92</td><td>ECTS</td></tr>
<tr><td>5.</td><td>Hours of unassisted student work</td><td colspan="5">70</td><td colspan="5">102</td><td>h</td></tr>
<tr><td>6.</td><td>Number of ECTS that student obtains working unassisted</td><td colspan="5">2,80</td><td colspan="5">4,08</td><td>ECTS</td></tr>
<tr><td>7.</td><td>Practical classes volume of work</td><td colspan="5">45</td><td colspan="5">27</td><td>h</td></tr>
<tr><td>8.</td><td>Number of ECTS obtained by student at practical classes</td><td colspan="5">1,80</td><td colspan="5">1,08</td><td>ECTS</td></tr>
<tr><td>9.</td><td>Total student's volume of work expressed in hours</td><td colspan="5">150</td><td colspan="5">150</td><td>h</td></tr>
<tr><td>10.</td><td>ECTS</td><td colspan="10">6</td><td>ECTS</td></tr>
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BIBLIOGRAPHY

1. F. P. Vesiliev, A, Yu. Ivanitskiy, In-Depth Analysis of Linear Programming
2. R. L. Rardin, Optimization in Operations Research
3. F. S. Hiller, G. J. Liebermann, Introduction to operation research, McGraw-Hill Publishing Company 1990
4. Hamdy A. Taha, Operations Research An Introduction