MODULE DESCRIPTION

Module code	full-time studies:	**Z-ZIP1-E-510**
	part-time studies:	**Z-ZIPN1-E-510**
Module name	**Operations Research**	
Module name in Polish	**Badania operacyjne**	
Valid from academic year	**2019/2020**	

MODULE PLACEMENT IN THE SYLLABUS

Field of study	**MANAGEMENT AND PRODUCTION ENGINEERING**
Level of education	**1st degree**
Studies profile	**General**
Form and method of conducting classes	**Full-time and Part-time**
Specialisation	**All**
Unit conducting the module	**Department of Mathematics and Physics**
Module co-ordinator	**Monika Skóra, PhD**
Approved by:	**Dariusz Bojczuk, PhD, DSc**

MODULE OVERVIEW

Type of subject / group of subjects	**Basic**
Module status	**Compulsory**
Language of conducting classes	**English**
Module placement in the syllabus - semester	**Semesetr V**
Initial requirements	**Calculus I**
Examination (YES/NO)	**NO**
Number of ECTS credit points	**2**

Method of conducting classes		**Lecture**	**Classes**	**Laborato-ry**	**Project**	**Other**
Per semester	full-time studies:	**15**		**15**		
	part-time studies:	**9**		**9**		

TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	A student knows techniques of obtaining, gathering, verifying, and processing data; a student also knows a mathematical description of basic issues of operational research.	ZIP1_W01
	W02	A student has knowledge as regards the range of operational research useful in formulating and solving issues as regards economy, management, and logistics. A student knows the methods of building simple mathematical model with analytical methods as well as methods using the available computer programs.	ZIP1_W02 ZIP1_W04 ZIP1_W10 ZIP1_W12 ZIP1_W14
Skills	U01	A student can plan research in order to gather the selected data and information (market, financial, concerning production organisation, etc.) in the form of simple databases. A student can also utilise the gathered data concerning a given problem as well as select an appropriate mathematical model.	ZIP1_U01 ZIP1_U02 ZIP1_U03
	U02	A student is able to analyse and forecast typical economic processes and phenomena essential for enterprise logistic activity. A student can also make optimal decisions in the analysed problems and formulate assessments as regards the causes and effects of the course of economic phenomena and processes; finally, a student can assess the usefulness of typical mathematical methods and verify a given model or a method of solving it.	ZIP1_U02 ZIP1_U03 ZIP1_U04 ZIP1_U05 ZIP1_U06 ZIP1_U08 ZIP1_U14 ZIP1_U18
Social competences	K01	A student understands the necessity of lifetime education in order to raise his/her professional qualifications in connection with economic and technological progress as well as with the development of science. In addition, a student understands basic connection between workload and the effect of work. Finally, a student is ready to act and think in an optimal manner.	ZIP1_K01 ZIP1_K02 ZIP1_K05

TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	Introduction to Operational Research. Linear programming: a mathematical model and the methods of solving it. The issue of transport as well as limiting certain problems to the transport issue Non-linear programming and its examples. The elements of dynamic programming. Graphs and decision trees. An allocation algorithm; stock control and the systems of mass service. The selected elements of strategic games and their application. One- and multi-criteria optimisation.
Laboratory	Solving optimisation tasks on the basis of knowledge and skills obtained on mathematical analysis courses. Linear programming: solving tasks using the graphical method, vertex points, and simplex. Verifying solutions as well as mathematical models (signed-number solutions). Linear programming: primal and dual problems. The issue of transport and solution methods. Solving linear promotion tasks (including the transport issue) with a computer. Non-linear programming and its problems. Solving tasks with elements of dynamic programming. Stock control and solving tasks connected with allocation. Strategic games and one- as well as multi-criteria optimisation in tasks.

METODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes *(select X)*					
	Oral exam	Written exam	Test	Project	Statement	Other
W01			X			
W02			X	X		
U01			X	X		
U02			X	X		
K01				X		

FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Credit with grade	Obtaining at least 50% of the points in the test.
Laboratory	Credit with grade	Obtaining at least 50% of points from tests during classes and from a self-made and presented example of applications of the known models.

STUDENT WORKLOAD

Balance of ECTS points												
No.	Type of student's activity	Student's workload										Unit
		full-time					part-time					
1.	Participation in the activities	Lc	C	Lb	P	O	Lc	C	Lb	P	O	h
		15		15			9		9			
2.	Other (consultation, exam)	2		2			2		2			h
3.	**Number of hours of a student's assisted work**	**34**					**22**					h
4.	**Number of ECTS credit points which are allocated for assisted work**	**1,4**					**0,9**					ECTS
5.	**Number of hours of a student's unassisted work**	**16**					**28**					h
6.	**Number of ECTS credit points which a student receives for unassisted work**	**0,6**					**1,1**					ECTS
7.	**Work input connected with practical classes**	**25**					**25**					h
8.	**Number of ECTS credit points which a student receives for practical classes**	**1,0**					**1,0**					ECTS
9.	**Total number of hours of a student's work**	**50**					**50**					h
10.	**Punkty ECTS za moduł** *1 ECTS=25 hours*	**2**										ECTS

LITERATURE

1. Mateo S.C., Ramón J.(2015), *Management science, operations research and project management*, Farnham; Burlington: Gower Publishing Limited.
2. Manuel J., Sánchez S. (2022), B*uilding and Solving Mathematical Programming Models: 50 Practical Examples*, International Series in Operations Research & Management Science, 329, Springer.
3. Hillier F.S., Lieberman G.J. (2020), *ISE Introduction to Operations Research,* ISE HED IRWIN INDUSTRIAL ENGINEERING, McGraw-Hill Education.