



MODULE DESCRIPTION

Module code	
Module name	Badania Operacyjne
Module name in English	Operational Research
Valid from academic year	2012/2013

MODULE PLACEMENT IN THE SYLLABUS

Subject	Elektrotechnology
Level of education	2nd degree <i>(1st degree / 2nd degree)</i>
Studies profile	General <i>(general / practical)</i>
Form and method of conducting classes	Full-time <i>(full-time / part-time)</i>
Specialisation	
Unit conducting the module	The Department of Control and Management Systems
Module co-ordinator	Jarosław Wikarek, PhD, Eng.
Approved by:	

MODULE OVERVIEW

Type of subject/group of subjects	Major <i>(basic / major / specialist subject / conjoint / other HES)</i>
Module status	Non-compulsory <i>(compulsory / non-compulsory)</i>
Language of conducting classes	Polish
Module placement in the syllabus - semester	7th semester
Subject realisation in the academic year	Winter semester <i>(winter / summer)</i>
Initial requirements	No requirements <i>(module codes / module names)</i>
Examination	No <i>(yes / no)</i>
Number of ECTS credit points	7

Method of conducting classes	Lecture	Classes	Laboratory	Project	Other
Per semester	30		15	30	



TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Module target	The essence and genesis of operational research. The formalisation of mathematical models for the selected decision-making problems. Linear programming and the simplex method. Integer linear programming – the bisection method, the method of estimation, and the cutting-plane method. Zero-one programming. Travelling Salesman Problem (TSP). Network programming. Dynamic programming. Flow in networks. Decision-making in uncertain conditions. Task ordering. Graph colouring. Programming in logic. Modelling issues in the selected packages of discrete optimisation. Sensitivity analysis of the obtained results. The aim of the module is to familiarise students with the methods of operational research applied in business processes optimisation. On completing the course, a student should be able to independently formulate simple models concerning decision-making problems. In addition, a student ought to be able to practically use appropriate analytical methods of operational research as decision analyses support tools in decision-making processes.
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Effect symbol	Teaching results	Teaching methods (I/c/l/p/other)	Reference to subject effects	Reference to effects of a field of study
W_01	A student is familiar with basic notions connected with operational research.	I	K_W17 K_W18	T1A_W02 T1A_W03 T1A_W05 T1A_W07
W_02	A student is knowledgeable as regards the formalisation of decision-making processes.	II	K_W17 K_W18	T1A_W02 T1A_W03 T1A_W05 T1A_W07
W_03	A student knows various algorithms and methods of solving decision-making problems.	II	K_W17 K_W18	T1A_W02 T1A_W03 T1A_W05 T1A_W07
W_04	A student knows various methods of evaluating the obtained solution.	I	K_W17 K_W18	T1A_W02 T1A_W03 T1A_W05 T1A_W07
U_01	A student can prepare a mathematical model for the selected decision-making problem.	I	K_U02 K_U03	T1A_U01 T1A_U08 T1A_U09 T1A_U14 T1A_U03 InzA_U06
U_02	A student can utilise methods and algorithms to solve the selected decision-making problem.	I	K_U02 K_U03	T1A_U01 T1A_U08 T1A_U09 T1A_U14 T1A_U03 InzA_U06
U_03	A student is capable of evaluating the obtained results and analyse the sensitivity of the obtained results.	I	K_U02 K_U03	T1A_U01 T1A_U08 T1A_U09 T1A_U14 T1A_U03 InzA_U06
K_01	A student can determine activity priorities.	I	K_U02	T1A_U02
K_02	A student is capable of teamwork.	I	K_U02	T1A_U02

Teaching contents:

Teaching contents as regards lectures

Lecture number	Teaching contents	Reference to teaching results for a module
1	Introduction to the subject.	W_01



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2	Problem formalisation.	W_02 W_03 W_04
3,4	Linear programming.	W_02 W_03 W_04
5,6	Integer linear programming.	W_02 W_03 W_04
7	Zero-one programming.	W_02 W_03 W_04
8	Dynamic programming.	W_02 W_03 W_04
9	Travelling Salesman Problem (TSP).	W_02 W_03 W_04
10	Flow in networks.	W_02 W_03 W_04
11	Decision-making in uncertain conditions.	W_02 W_03 W_04
12	Task ordering.	W_02 W_03 W_04
13	The queuing theory.	W_02 W_03 W_04
14	Multi-criteria programming.	W_02 W_03 W_04
15	Multi-criteria programming. CLP.	W_02 W_03 W_04

Teaching contents as regards laboratory classes

Laboratory classes are conducted in teams of two students.

Laboratory class number	Teaching contents	Reference to teaching results for a module
1	Introduction to the subject of laboratory classes. Familiarising students with the laboratory environment and the principles of work.	K_01 K_02
2	Discrete optimisation packages. Linear programming.	W_02 W_03 W_04 U_01 U_02 U_03 K_01 K_02
3	Integer linear programming and zero-one programming.	W_02 W_03 W_04 U_01 U_02 U_03 K_01 K_02
4	Dynamic programming. Travelling Salesman Problem (TSP).	W_02 W_03 W_04 U_01 U_02 U_03 K_01 K_02
5	Flows in networks. Decision-making in uncertain conditions.	W_02 W_03 W_04 U_01 U_02 U_03 K_01 K_02
6	Task ordering.	W_02 W_03 W_04 U_01 U_02 U_03 K_01 K_02
7	The queuing theory.	W_02 W_03 W_04 U_01 U_02 U_03 K_01 K_02
8	Multi-criteria programming. CLP.	W_02 W_03 W_04 U_01 U_02 U_03 K_01 K_02

The methods of assessing teaching results

Effect symbol	Methods of assessing teaching results <i>(assessment method, including skills – reference to a particular project, laboratory assignments, etc.)</i>
W_01	A final test on the lectures. Reports on laboratory classes.
W_02	A final test on the lectures. Reports on laboratory classes.
W_03	A final test on the lectures. Reports on laboratory classes.
W_04	A final test on the lectures. Reports on laboratory classes.
U_01	Reports on laboratory classes.
U_02	Reports on laboratory classes.
U_03	Reports on laboratory classes.
K_01	Reports on laboratory classes.
K_02	Reports on laboratory classes.



STUDENT'S INPUT

ECTS credit points		
	Type of student's activity	Student's workload
1	Participation in lectures	30
2	Participation in classes	
3	Participation in laboratories	15
4	Participation in tutorials (2-3 times per semester)	5
5	Participation in project classes	30
6	Project tutorials	10
7	Participation in an examination	
8		
9	Number of hours requiring a lecturer's assistance	90 <i>(sum)</i>
10	Number of ECTS credit points which are allocated for assisted work <i>(1 ECTS credit point=25-30 hours)</i>	3.6
11	Unassisted study of lecture subjects	10
12	Unassisted preparation for classes	
13	Unassisted preparation for tests	
14	Unassisted preparation for laboratories	15
15	Preparing reports	10
16	Preparing for a final laboratory test	10
17	Preparing a project or documentation	30
18	Preparing for an examination	10
19	Preparing questionnaires	
20	Number of hours of a student's unassisted work	85 <i>(sum)</i>
21	Number of ECTS credit points which a student receives for unassisted work <i>(1 ECTS credit point=25-30 hours)</i>	3.4
22	Total number of hours of a student's work	175
23	ECTS credit points per module <i>1 ECTS credit point=25-30 hours</i>	7
24	Work input connected with practical classes <i>Total number of hours connected with practical classes</i>	125
25	Number of ECTS credit points which a student receives for practical classes <i>(1 ECTS credit point=25-30 hours)</i>	5