Zał. nr 4 do ZW 64/2012

Faculty of Computer Science and Management

SUBJECT CARD

Name in Polish: Optymalizacja Dyskretna i Przepływy w Sieciach
Name in English: Discrete Optimization and Network Flows
Main field of study (if applicable): Management
Specialization (if applicable): Business Information Systems
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: IEZ1206
Group of courses NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	60		60		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1		0.5		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic skills in operations research, algebra and logic.
2. Basic skills in computer programming.

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SUBJECT OBJECTIVES

C1. Presenting some basic network flow problems such as the shortest (longest) path, maximum flow, minimum cost flow and transportation problems.
C2. Presenting some basic combinatorial optimization problems such as the traveling salesperson, minimum spanning tree, minimum assignment, minimum cut and 0-1 knapsack problems.
C3. Showing some algorithms which can be applied to solve the problems listed in points C1 and C2, in particular presenting the network simplex algorithm for the minimum cost flow problem.
C4. Showing some practical applications of discrete optimization and network flow problems.
C5. Presenting some computer software which can be used to solve network flow and discrete optimization problems.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - Knows and understands theoretical foundations, advanced formal methods, and decision support tools, including discrete optimization, decision theory, and game theory in solving practical decision-making problems.

relating to skills:

PEK_U01 - Can choose and use advanced formal methods and decision support tools.

relating to social competences:

PEK_K01 – Is ready to identify, critically analyze and solve problems that arise in practice. Can anticipate the effects of his decisions.

PEK_K02 – Is ready to explore and select flexibly the methods and tools for solving problems that arise in practice.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of h.**
Lec 1	Introduction to network flow problems – basic definitions and models	2
Lec 2	Algorithms, running time of algorithms, network representations and some basic network algorithms	2
Lec 3	The shortest path problem – formulation and applications	2
Lec 4	Algorithms for solving the shortest path problem	2
Lec 5	The longest path problem and its applications to project scheduling (the critical path method)	2
Lec 6	The maximum flow and minimum cut problems – formulation and applications. Fulkerson-Ford algorithm for the maximum flow and minimum cut problems	2
Lec 7	Minimum cost flow problem – formulation and applications; cycle cancelling algorithm for the minimum cost flow problem	2
Lec 8	The network simplex algorithm for the minimum cost flow problem	2
Lec 9	The network simplex algorithm for the minimum cost flow problem and the sensitivity analysis	2
Lec 10	The transportation problem – formulation and applications	2
Lec 11	The network simplex algorithm for the transportation problem	2
Lec 12	The minimum assignment and the minimum spanning tree problems – formulation, applications and methods of solving	2
Lec 13	The traveling salesperson problem – formulation, applications and methods of solving	2
Lec 14	Some methods of solving hard discrete optimization problems – local search, branch and bound algorithm and Lagrangean relaxation.	2
Lec 15	Written test	2
	Total hours:	**30**

Form of classes - laboratory		Number of hours
Lab 1	Introduction; presenting some computer software which can be used to solve network flow and discrete optimization problems	1
Lab 2	Building and solving network flow models for practical problems	2
Lab 3	Building and solving network flow models for practical problems	2
Lab 4	Building and solving network flow models for practical problems	2
Lab 5	Building and solving network flow models for practical problems	2
Lab 6	Building and solving discrete optimization models for practical problems	2
Lab 7	Building and solving discrete optimization models for practical problems	2
Lab 8	Written test	2
	Total hours:	**15**

TEACHING TOOLS USED
N1. Presentation N2. Case study N3. Solving exercises N4. Using computer software

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
P	PEK_W01	Written test
P	PEK_U01	Written test
C=1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] R. K. Ahuja, T. L. Magnanti, J. B. Orlin. Network flows: theory, algorithms and applications. Prentice Hall, New Jersey 1993

[2] M. S. Bazaara, J.J. Jarvis, H.D. Sherali. Linear programming and network flows. John Wiley and Sons, 1990.

[3] A. Kasperski. Discrete optimization and network flows. Business Information Systems, PRINTPAP 2011

SECONDARY LITERATURE:

[1] E. L. Lawler. Combinatorial optimization. Network flows and matroids. Holt Reinhart and Wilson 1976.

[2] C. H. Papadimitriou, K. Steiglitz. Combinatorial optimization. Algorithms and complexity. Dover Publications Inc. 1998
[3] H. Taha. Operations research. An introduction. Prentice Hall 2011.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Discrete Optimization and Network Flows
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY Management
AND SPECIALIZATION Business Information Systems

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Programme content***	Teaching tool number***
PEK_W01	K2_ZARZ_W08 K2_ZARZ_W13 S2_BIS_W02	C1, C2, C3, C4	Lec1 –Lec14	N1, N2, N3
PEK_U01	K2_ZARZ_U10 S2_BIS_U02	C4, C5	Lab1 - Lab7	N3, N4
PEK_K01	K2_ZARZ_K04 K2_ZARZ_K05	C4	Lab1 – Lab7	N3, N4
PEK_K02	K2_ZARZ_K04 K2_ZARZ_K05	C4	Lab1 – Lab7	N3, N4

** - enter symbols for main-field-of-study/specialization educational effects
*** - from table above