COURSE GUIDE

Subject name	**Operational research**
Course of study	**Quality Management and Production**
The form of study	**full-time**
Level of qualification	**1st cycle full-time studies (engineering)**
Year	**II**
Semester	**3**
The implementing entity	**Department of Econometrics and Statistics**
The person responsible for preparing	**Jan Kowalik**
Profile	**General academic**
Course type	**basic/~~principal/elective/other~~**
ECTS points	**3**

TYPE OF TEACHING – NUMBER OF HOURS PER SEMESTER

LECTURE	CLASS	LABORATORY	PROJECT	SEMINAR
15	**15**	**-**	**-**	**-**

COURSE AIMS

C1. To familiarize students with the theoretical foundations of operational research.
C2. Creation of skills to construct mathematical models for production and transportation problems.
C3. Creation of students ability to apply appropriate methods of operations research to search for the optimal solution using specialized computer packages and individual interpretation and verification of the results.
C4. Creation of competencies for individual analysis of economic and social phenomena and processes with the use of operations research.

ENTRY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. A student should know the foundations of mathematical analysis.
2. A student should identify and understand the basic terms in the field of socio-economics.

3. A student should plan the computational procedures and use their new skills to work with different computing packages.
4. A student should be able to organize self work with the principles of logical inference.

LEARNING OUTCOMES

EK 1- A student is able to mention the principle of modeling economic phenomena.
EK 2- A student is able to identify methods of searching for optimal solutions.
EK 3- Student is able to find and interpret the optimal solution for a given problem and a student is able to make sensitivity analysis.

COURSE CONTENT

Type of teaching – LECTURES	**Number of hours**
W 1 – The theoretical foundations of operational research.	**2**
W 2 – Linear optimization - modeling decision problems, the primal and the dual program.	**2**
W 3 – Linear optimization – the geometric method for determining the optimal solution.	**1**
W 4 – Linear optimization – simplex algorithm.	**3**
W 5 – Linear optimization – sensitive analysis.	**2**
W 6 – Closed and open transportation problem.	**1**
W 7 – Transportation algorithm.	**1**
W 8 – The theoretical foundations of network programming.	**1**
W 9 – Network programming – critical path method and PERT method.	**2**
Type of teaching – CLASSES	**Number of hours**
C 1 –The optimal choice of the range of products using the geometric method – the primal problem.	**2**
C 2 – The search for the optimal solution for the blending problem.	**2**
C 3 – The search for the optimal solution for the dual program.	**1**
C 4 – The search for the optimal solution for linear programming problems using the simplex algorithm.	**2**
C 5 – Determining impact of different values of an independent variable on a particular dependent variable under a given set of assumptions .	**2**
C 6 – The search for the optimal solution for the classical transportation problem.	**2**
C 7 – The search for the optimal solution for the production-transportation	**2**

problem.	
C 8 – The issue of the location of production and minimizing empty runs.	**1**
C 9 – Network methods with the determined logical structure: CPM, PERT.	**1**

TEACHING TOOLS

1. Table, chalk
2. PCs and projector
3. Microsoft Office *Excel*
4. Manuals, yearbooks, databases

WAYS OF ASSESSMENT (F – FORMATIVE, P – SUMMATIVE)

F1. The current assessment of students activity
F2. The assessment of students creativity in the team-working
F3. Tests verifying the effects of teaching at different education levels and skills in the field of use of computer packages
P1. Comprehensive evaluation of students work including

STUDENT WORKLOAD

Form of activity		**Average number of hours for realization of the activity**		
		[h]	ECTS	ECTS
Contact hours with the teacher	LECTURES	**15**	**0,6**	**1,2**
Preparation for lectures		**10**	**0,3**	
Preparation for tests		**9**	**0,3**	
Contact hours with the teacher	CLASSES	**15**	**1,0**	**1,8**
Preparation for classes		**15**	**0,4**	
Preparation for tests		**11**	**0,4**	
TOTAL NUMBER OF HOURS / ECTS POINTS FOR THE COURSE		**75**	**3**	

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

Basic resources:

1.	A.P. Verma, Operations Research, S. K. Kataria & Sons, 2009
2.	P.K. Gupta, D.S. Hira, Operations Research, S. Chand, 1991

Supplementary resources:

1.	J.K. Sharma, Operations Research, Theory and Application, Macmillan India Limited, 2006
2.	F. S. Hillier, F.J. Lieberman, Introduction To Operations Research, Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2002
3.	J.K. Sharma, Operations Research, Theory and Application, Macmillan India Limited, 2006

TEACHERS (NAME, SURNAME, E-MAIL ADDRESS)

1. **Jan Kowalik, janekowalik@yahoo.pl, jkowalik@zim.pcz.pl, jan.kowalik@wz.pcz.pl**
2.

MATRIX OF LEARNING OUTCOMES REALISATION

Learning outcome	Reference of given outcome to outcomes defined for whole program	Course aims	Course content	Teaching tools	Ways of assessment
EK1	K_W01, K_W02, K_U06, K_U07, K_K02, K_K03	C1	W1,W2,W6, W8	1,2,3,4	F1,F2, F3
EK2	K_W01, K_W02, K_U06, K_U07, K_K02, K_K03	C1, C3	W3, W4, W7, W9, C1, C2, C3, C4, C5, C6, C7, C8, C9	1,2,3,4	F1,F2, F3, P1
EK3	K_W01, K_W02, K_U02, K_U06, K_U07, K_K02, K_K03	C1, C2, C3, C4	W3, W4, W5, W7, C1, C2, C3, C4, C5, C6, C7, C8, C9	1,2,3,4	F1,F2, F3, P1

FORM OF ASSESSMENT - DETAILS

	grade 2	grade 3	grade 4	grade 5
EK 1	Student doesn't know the principles of modeling of economic phenomena.	Student is able to mention the principles of modeling of economic phenomena.	Student is able to mention the principles of modeling of economic phenomena and to define the decision problem .	Student is able to mention the principles of modeling of economic phenomena and to define the decision problem and present it in the form of a mathematical model.
EK 2	Student doesn't know the method of searching for optimal solutions.	Student is able to mention the method of searching for optimal solutions.	Student is able to mention the method of searching for optimal solutions and assign them to specific cases.	Student is able to mention the method of searching for optimal solutions and assign them to specific cases and critically evaluate the possibilities of obtaining the optimal solution.

EK 3	Student can’t find and correctly interpret the optimal solution for a given problem.	Student tries to find and interpret optimal solutions and make sensitivity analysis.	Student can find and correctly interpret the optimal solution for a given problem and make sensitivity analysis.	Student can independently propose appropriate methods to optimize solutions for a given problem and make sensitivity analysis.

ADDITIONAL USEFUL INFORMATION ABOUT THE COURSE

1. Information where presentation of classes, instruction, subjects of seminars can be found, etc. -
2. Information on the place where the classes take place -
3. Information on the date of classes (day of the week/hour) -
4. Information on consultation hours (hours + place) -

……
Coordinator