DESCRIPTION OF THE SUBJECT

FIELD OF STUDY	**Management**
SPECIALISATION	All
MODE OF STUDY	Full-time / Part-time
SEMESTER	3

Name of the subject	**Operational research**	MO_1_6
Hourly dimension of particular forms of classes	Full-time studies – 45 Part-time studies – 45	
• **lectures**	Full-time studies – 10 Part-time studies – 10	
• **other forms**	Full-time studies – 35 Part-time studies – 35	

Learning objectives:	– to present the principles of formulating optimization resources; – to present the selection of appropriate analytical methods for solving a problem; – to learn how to apply the method of operational research as a tool supporting decision-making analyses.

Learning outcomes for the subject			
Number	**Learning outcomes, a student who has successfully completed the course will be able to:**	**Reference of learning outcomes for the programme**	**The reference to the learning outcomes for the area**
EK_W01	present the principles for the formulation of optimisation resources	K_W03	P7S_WG
EK_W02	define methods and tools of operational research as tools supporting decision-making processes	K_W14	P7S_WK
EK_U03	apply theoretical knowledge of operational research in practice	K_U03	P7S_UW
EK_U04	diagnose and solve the problem using appropriate operational methods	K_U05	P7S_UW
EK_K05	work in a team based on operational research	K_K07	P7S_KR
EK_K06	recommends the appropriate use of operational research methods	K_K01	P7S_KK

Content number	**Educational/ curricular content**	**Reference to learning outcomes for the subject**
	Lectures/Exercises	

T_01	The essence of operations research - its genesis.	EK_W01
T_02	Linear programming.	EK_W02
T_03	Integer programming in operational optimization problems.	EK_W01 EK_W02 EK_U03
T_04	Non-linear programming.	EK_W02 EK_U03
T_05	Network programming methods.	EK_W02 EK_U03 EK_K05 EK_K06
T_06	Multicriteria comparative analysis in optimization problems.	EK_W01 EK_U04 EK_K05 EK_K06

Methods and forms of teaching	**Educational and curricular content**
Lecture with Multimedia presentation of selected issues	
Conversation lecture	
Problem-based lecture	
Informative lecture	T_01 – 06
Discussion	
Work with text	
Case study method	
Problem-based learning	
Didactic/simulation game	
Exercise method	T_02 – 06
Workshop method	
Project method	
Multimedia presentation	
Audio and/or video demonstration	
Activating methods (e.g. brainstorming, SWOT analysis technique, decision tree technique, snowball method, constructing mind maps)	
Inne (jakie?) – rozwiązywanie zadań	T_02 – 06
…	

Evaluation criteria in relation to particular learning outcomes				
Learning outcome	**For the assessment 2**	**For the assessment 3**	**For the assessment 4**	**For the assessment 5**
EK_W01	The student is not able to present the principles of formulating optimization resources.	The student is able to present the principles of formulating optimisation resources to a small extent.	The student is able to present the principles of formulating optimization resources.	The student is able to give an excellent presentation of the principles of formulating optimisation resources.

EK_W02	The student is not able to identify methods or tools of operational research as tools supporting decision-making processes.	Student is able to not fully independently determine the methods and tools of operational research as tools supporting decision-making processes.	Students will be able to identify methods and tools of operational research as tools supporting decision-making processes.	The student is able to identify very well the methods and tools of operational research as tools supporting decision-making processes.
EK_U03	The student is not able to use theoretical knowledge of operational research in practice.	The student is able to sufficiently apply theoretical knowledge of operational research in practice.	The student is able to use theoretical knowledge of operational research in practice.	The student is able to use theoretical knowledge of operational research in a thoughtful and fully independent way in practice.
EK_U04	The student is unable to diagnose and solve the problem using appropriate operational methods.	The student is able to diagnose the problem to a limited extent, but is not able to solve the problem independently using appropriate operational methods.	The student is able to diagnose and solve a problem using appropriate operational methods.	The student is excellent at diagnosing and solving problems using appropriate operational methods.
EK_K05	The student is not able to work in a team based on operational research	The student is able to work in a team basing its activities on operational research to a small extent.	The student is able to work in a team basing its activities on operational research.	The student is not only able to work in a team based on operational research, but also to give it field of study.
EK_K06	The student does not recommend the appropriate use of operational research methods	The student makes limited recommendations for appropriate use of operational research methods	Student recommends appropriate use of operational research methods	The student excels in recommending the appropriate use of operational research methods

Verification of learning outcomes	**EK symbols for the module/subject**					
	W01	W02	U03	U04	K05	K06
Written test	X	X	X	X		
Oral exam						
Written credit						
Oral credit						
Written colloquium	X	X	X	X		
Oral colloquium						
Test						
Project						
Written work						
Report						
Multimedia presentation						
Work during exercises	X	X	X	X	X	X
Inne (jakie?) –						

Hourly teaching load and student workload	Full-time studies	Part-time studies
1. Lectures (joint participation of academics and students)	10	10
2. Other forms (joint participation of academic staff and students)	35	35
3. Consultation with the teacher	15	15
Total 1+2+3	**60**	**60**

4. Internships (carried out by students on their own)	—	—
5. Student's own work (including homework and project work, preparation for a credit/exam)	40	40
Total 4+5	**40**	**40**
SUMMARY 1+2+3+4+5	**100**	**100**
Total ECTS credits according to the study plan	**4**	

Reference literature	– Grabowski W., *Programowanie matematyczne*, PWE, Warszawa 1980. – Ignasiak E. (red), *Badania Operacyjne*, PWE, Warszawa 1997. – Lipiec-Zajchowska M. (red.): Wspomaganie procesów decyzyjnych. Tom III. Badania Operacyjne, Wyd. C.H. Beck, Warszawa 2003. – Radzikowski W., *Badania operacyjne w zarządzaniu przedsiębiorstwem*, Wydawnictwo Uniwersytetu im. M. Kopernika w Toruniu, Toruń 1997. – Stachurski A., Wierzbicki A.P., *Podstawy optymalizacji*, Oficyna Wyd. Politechniki Warszawskiej, Warszawa 1999. – Wiśniewski E., *Podejmowanie decyzji. Wybrane zagadnienia*, Wyd. Politechniki Koszalińskiej, Koszalin 1998.
Complementary literature	– Nowak J.J., *Wprowadzenie do matematycznego formułowania problemów decyzyjnych*, Wyd. IBS PAN, Warszawa 1999. – Tyszer J., *Symulacja cyfrowa*, WNT, Warszawa 1990.