KARTA PRZEDMIOTU

I.   Dane podstawowe

Nazwa przedmiotu	Badania operacyjne
Nazwa przedmiotu w języku angielskim	Operations research
Kierunek studiów	Matematyka (Mathematics)
Poziom studiów (I, II, jednolite magisterskie)	I
Forma studiów (stacjonarne, niestacjonarne)	Stacjonarne (Full-time studies)
Dyscyplina	Matematyka (Mathematics)
Język wykładowy	Angielski (English)

Koordynator przedmiotu/osoba odpowiedzialna	Dr hab. Dariusz Partyka

Forma zajęć *(katalog zamknięty ze słownika)*	Liczba godzin	Semestr	Punkty ECTS
wykład	30	2 or 4 or 6	5
konwersatorium			
ćwiczenia	30	2 or 4 or 6	
laboratorium			
warsztaty			
seminarium			
proseminarium			
lektorat			
praktyki			
zajęcia terenowe			
pracownia dyplomowa			
translatorium			
wizyta studyjna			

Wymagania wstępne	Basis knowledge of mathematical logic, set theory, linear algebra, analytic geometry, real analysis and topology.

II.   Cele kształcenia dla przedmiotu

C1. To familiarize students with the subject of operations research and the basic issues and methods of mathematical programming.

III. **Efekty uczenia się dla przedmiotu wraz z odniesieniem do efektów kierunkowych**

Symbol	Opis efektu przedmiotowego	Odniesienie do efektu kierunkowego
WIEDZA		
W_01	The student understands what is the process of construction and analysis of mathematical models in other fields of science. Understands what is the optimal decision making by means of operations research. Knows the concept of decision making model.	K_W01, K_W03
W_02	The student knows the basic methods used in operations research. Is familiar with examples illustrating the application of these methods.	K_W03, K_W05
W_03	The student knows the proofs of the fundamental theorems in the scope of operations research.	K_W04
UMIEJĘTNOŚCI		
U_01	Student can use a mathematical formalism for the construction of decision models. Uses the notion of a linear space, linear functional, convex set and convex function. Identifies problems that can be solved using linear programming.	K_U04, K_U06, K_U11, K_U16, K_U17,K_U38
U_02	Student knows the theoretical foundations of the simplex method. Can apply this method in the practical aspects. Can construct the dual problem for a given linear programming problem. Understands the specificity of the transportation problem. Is versed in the methods used in nonlinear programming issues.	K_U04, K_U06, K_U11, K_U12, K_U16, K_U19, K_U25, K_U38
U_03	The student can use MS Excel to implement mathematical programming problems. Can use the Solver module in order to solve them. Knows how to interpret the reports of the sensitivity of solutions and the dual prices. Can implement and solve linear programming problems for integer and binary integer models. Can implement and solve discrete programming and network optimization problems.	K_U11, K_U25, K_U28, K_U38
KOMPETENCJE SPOŁECZNE		
K_01	The student understands the need to further develop his knowledge and skills in operations research. Can formulate questions in order to better understand the subject.	K_K02
K_02	The student can present issues dealing with operations research in an understandable way.	K_K05

IV. **Opis przedmiotu/ treści programowe**

1. Optimal decision making by means of operations research.
2. Decision making model (decisions, available decisions, the utility of a particular decision, optimal decision).
3. Linear space and linear functionals. Convex sets and functions.
4. Linear programming (geometrical interpretation of an optimal decision, examples of linear optimization problems).
5. Dual problems in linear programming.

6. Simplex method.
7. Transportation problems.
8. The integer linear programming and binary integer linear programming.
9. Discrete programming.
10. Selected topics of nonlinear programming (linearization of certain nonlinear programming problems, convex optimization, quadratic programming).
11. Implementation of mathematical programming topics in Microsoft Excel electronic spread-sheet. Applying Solver module for solving them.
12. Sensitivity analysis for optimal decision in linear programming.
13. Remarks on the dynamic programming and network optimization.

V. Metody realizacji i weryfikacji efektów uczenia się

Symbol efektu	Metody dydaktyczne *(lista wyboru)*	Metody weryfikacji *(lista wyboru)*	Sposoby dokumentacji *(lista wyboru)*
WIEDZA			
W_01	Conventional lecture, practical classes.	Test, written exam.	Evaluated test, protocol.
W_02	Conventional lecture, practical classes.	Test, written exam.	Evaluated test, protocol.
W_03	Conventional lecture, practical classes.	Test, written exam.	Evaluated test, protocol.
UMIEJĘTNOŚCI			
U_01	Conventional lecture, practical classes.	Test, written exam.	Evaluated test, protocol.
U_02	Conventional lecture, practical classes.	Test, written exam.	Evaluated test, protocol.
U_03	Conventional lecture, practical classes.	Test of practical skills.	File.
KOMPETENCJE SPOŁECZNE			
K_01	Discussion.	Observation.	Observation report.
K_02	Discussion.	Observation.	Observation report.

VI. Kryteria oceny, wagi…

LECTURE:

The completion of classes is required.

Written exam constitute the final grade:

91 – 100% (5,0)

81 – 90% (4,5)

71 – 80% (4,0)

61 – 70% (3,5)

51 – 60% (3,0)

Less than 51% (2,0)

CLASSES:

At least 80% of attendance is required.

Two tests together constitute the final grade:

91 – 100% (5,0)

81 – 90% (4,5)

71 – 80% (4,0)

61 – 70% (3,5)

51 – 60% (3,0)

Less than 51% (2,0)

Detailed rules of evaluation are given on lectures and classes.

VII. Obciążenie pracą studenta

Forma aktywności studenta	Liczba godzin
Liczba godzin kontaktowych z nauczycielem	90
Liczba godzin indywidualnej pracy studenta	60

VIII. Literatura

Literatura podstawowa
Lecture notes and lecture notes in electronic form as well as 1. P.R. Murthy, *Operations research*, New Age International (P) Ltd., Publishers, New Delhi. 2. J. Stacho, *Introduction to Operations Research*, Columbia University, New York. 3. W. Grabowski, *Programowanie matematyczne*, PWE, Warszawa 1980. 4. E. Ignasiak (red.), *Badania operacyjne*, PWE, Warszawa 1996. 5. K. Kukuła (red.), *Badania operacyjne w przykładach i zadaniach*, Wyd. Nauk. PWN, Warszawa 1999. 6. I. Nykowski, *Programowanie liniowe*, PWE, Warszawa 1986. 7. T. Szapiro (red.), *Decyzje menedżerskie z Excelem*, PWE, Warszawa 2000.
Literatura uzupełniająca
1. H. Lyeme, M. Seleman, *Introduction to Operations Research*, Lap Lambert Academic Publishing, Germany. 2. Wayne L. Winston, *Operations Research. Applications and Algorithms*, Thomson Brooks/Cole, Australia. 3. M.M. Sysło, D. Narsingh, J.S. Kowalik, *Algorytmy optymalizacji dyskretnej*, Wyd. Nauk. PWN, Warszawa 1995. 4. H.M. Wagner, *Badania operacyjne*, PWE, Warszawa 1980. 5. S. Walkiewicz, *Programowanie dyskretne*, PWN, Warszawa 1986.