



SZKOŁA GŁÓWNA
GOSPODARSTWA
WIEJSKIEGO

Operational Research - Applications

Educational subject description sheet

Basic information

Field of study Informatics and Econometrics Speciality - Organizational unit Faculty of Applied Informatics and Mathematics Study level second cycle (post bachelor's degree) Study form full-time studies Education profile General academic		Didactic cycle 2024/25 Subject code ZIMIEJS_D.21K.02487.24 Lecture languages english Mandatory Obligatory subjects Block Major subjects Disciplines Economics and finance
Coordinator	Urszula Grzybowska	
Teacher	Urszula Grzybowska	
Period Semester 1	Examination Exam Activities and hours Lecture: 15 Laboratory exercises: 30	Number of ECTS points 3

Goals

Code	Goal
C1	acquaint students with basic optimization problems of management,
C2	acquaint students with tools used in decision making problems
C3	acquaint students with mathematical methods and algorithms used in Operations Research.

Entry requirements

Basic calculus, Linear algebra, Matrix operations, spreadsheet skills

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge - Student knows and understands:			
W1	the areas of applications of OR in management.	IEj_K2_W01	Written exam, Written credit, Test (written or computer based)
W2	methods and algorithms used in decision making problems.	IEj_K2_W06	Written exam, Written credit, Test (written or computer based)
W3	optimization methods and methods of supporting decision making process.	IEj_K2_W07	Written exam, Written credit, Test (written or computer based)
W4	mathematical methods and algorithms used in Operations Research	IEj_K2_W10	Written exam, Written credit, Test (written or computer based)
Skills - Student can:			
U1	identify decision making problems and assign them to relevant class of problems, build mathematical models of decision problems in management, interpret obtained results and based on them make optimal decisions	IEj_K2_U06	Written credit, Test (written or computer based)
U2	use computer software in decision making process	IEj_K2_U13	Written credit, Test (written or computer based)

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Linear programming: basic notions and methods, sensitivity analysis, dual problem.	W2, W3, W4	Lecture
2.	Transportation problem, Optimal routing, Allocation problem, Assignment problem	W1, U1	Lecture
3.	Project planning: project network, Critical Path Method, PERT, crashing a project	W2	Lecture
4.	Decision Making Under Risk and Uncertainty	W1, U1	Lecture
5.	Multicriteria Decision Making	W3	Lecture
6.	Linear programming- graphical method. Examples of application: optimal diet, a product mix problem, paper roll trimming, production planning, sensitivity analysis;	W4, U1, U2	Laboratory exercises
7.	Dual problem as a method of solving primal problem.	W2	Laboratory exercises

No.	Course content	Subject's learning outcomes	Activities
8.	Transportation problem: Optimal routing, Allocation problem, Assignment problem.	W1, U1, U2	Laboratory exercises
9.	Project planning: project network, Critical Path Method, PERT, crashing a project.	W1, W3, U1	Laboratory exercises
10.	Decision Making under risk and uncertainty. Maximum expected profit. Payoff matrix	W1, W3, U1	Laboratory exercises

Course advanced

Activities	Methods of conducting classes
Lecture	Lecture, Case study, Presentation
Laboratory exercises	Case study, Brainstorm, Problem solving, Teamwork, Individual work

Activities	Examination method	Percentage
Lecture	Written exam	50%
Laboratory exercises	Written credit	25%
Laboratory exercises	Test (written or computer based)	25%

Activities	Credit conditions
Lecture	Written exam in two parts with points. The exam is passed when the total score is at least 50% of the maximum score.
Laboratory exercises	Computer tests and one written test with points. The total score for computer tests must be at least 50%, the same for written test.

Literature

Obligatory

1. Introduction to Operations Research. Concepts and Cases, F. S. Hillier, G. J. Lieberman, McGraw Hill, 2007
2. Linear Programming: Foundations and Extensions free ebook:
<http://ebookbrowse.com/linear-programming-foundations-and-extensions-pdf-d8547783>
3. Introduction to Finite Mathematics J. G. Kemeny, J. L. Snell, and G. L. Thompson Chapter Linear programming and the theory of games.

Optional

1. Mathematical Models In Social Sciences J.G. Kemeny, J. L. Snell, MIT Press
2. Operations Research. Linear Programming. P. Rama Murthy
3. Operations Research P. Rama Murthy, New Age International, 2007
4. Operations Research: A Practical Introduction. Carter Michael Crc Pr Inc, 2023
5. Operations Research: An Introduction (10th Edition) Taha IE, Pearson

Calculation of ECTS points

Activity form	Activity hours*
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Lecture	15
Laboratory exercises	30
Self-study on the content covered in class	15
Preparation for exercises	10
Preparation for the test	10
Preparation for the exam	10
Student workload	Hours 90
Number of ECTS points	ECTS 3

* hour means 45 minutes

Effects

Code	Content
IEj_K2_U06	label.effect.prefix.skillThe graduate can apply acquired knowledge in different scopes and forms, extended by a critical analysis of the effectiveness and usefulness of applied knowledge in practice.
IEj_K2_U13	label.effect.prefix.skillThe graduates can use information systems to solve advanced problems in economics, applications of computer science in the life sciences, and others.
IEj_K2_W01	label.effect.prefix.knowledgeThe graduate knows and understands the nature of economic sciences, their place in the system of sciences, and their relationship to the sciences, technology, and natural sciences, as well as trends, the role of man as a creator of culture, and the economic and legal system.
IEj_K2_W06	label.effect.prefix.knowledgeThe graduate knows and understands to an extended degree the algorithms and their computational complexity, computer systems architecture, operating systems, network technologies, programming languages and paradigms, artificial intelligence, databases, and software engineering.
IEj_K2_W07	label.effect.prefix.knowledgeThe graduate knows and understands to an extended degree the economic decision optimization methods and (including computer) decision support systems, modern trends in the field, concerning e.g. artificial neural networks and genetic algorithms.
IEj_K2_W10	label.effect.prefix.knowledgeThe graduate knows and understands in-depth mathematics (statistics, differential equations, and elements of functional analysis) to the extent necessary to describe dynamic economic processes, create econometric models as well as write algorithms and other activities in the field of computer science.