COURSE DESCRIPTION CARD - SYLLABUS

Course name

Operational research

Course

Field of study

Management and production engeenering

Year/Semester

2/4

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	
Tutorials	Projects/seminars	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

The student knows the basic knowledge of mathematical analysis and algebra.

The student is able to use the appropriate notation of mathematical formulas.

The student knows how to use the matrix calculation.

Course objective

The student acquires the skills to understand the problems posed regarding decision-making situations taking place primarily in economics.

The student learns the methods (algorithms) and mechanisms (computer packages) used to solve the discussed issues.

Student of using information obtained from the library, from the Internet, from "help" included in the supported software

Course-related learning outcomes

Knowledge

The student knows and understands the basic definitions and theorems related to the subject - operations research.

The student is able to recognize (from the content of the task) what issue is discussed.

The student is able to choose and apply the right tool (program and algorithm) to solve the discussed tasks

The student is able to characterize the basic issues of linear programming, taking into account the transport issue, allocation and quotient programming.

The student is able to describe and apply the learned algorithms for solving the discussed issues.

Skills

The student has the ability to think logically.

The student understands the content of the read "task with content", is able to properly discuss it.

The student knows how to write the task in the form of a mathematical model from the interpretation of the content of the task.

By using appropriate tools (computer program) and methods (algorithms), the student is able to solve the discussed task together with the interpretation of the obtained result.

The student is aware that when performing computer calculations, it is necessary to know which calculation algorithm was used in a given program to obtain the results.

The student is able to explain and interpret the result obtained at each step of the calculation algorithm used.

Social competences

Student understanding the need to learn and acquire new knowledge.

The student is aware of the existence of various packages of computer programs (solvers) used to perform mathematical calculations, with the consequences of their different handling - which forces continuous independent development in order to adapt.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired at the lecture and at the laboratory is verified in the form of:

- tasks recommended for conversion during classes (laboratory / lecture), this is an activity during classes

- final test which is conducted during the last class

Colloquium from the lecture:

- takes two optional forms (lecturer decides):

1) test with open and closed questions, tasks are scored differently,

2) traditional form, 3 tasks to be solved (on a piece of paper, without the use of software) with an appropriate (known) algorithm, the tasks are scored equally

Passing threshold: 50%

Laboratory test:

to solve 3 - 4 problems (in the form of "content problem"), which include:

a) save in the form of an appropriate mathematical model

b) solve using the appropriate software (to be specified by the teacher), giving and interpreting the obtained results.

Passing threshold: 50%.

Programme content

Lecture:

1. Introducing the basic terminology related to linear programming (including notions: mathematical model, objective function, optimization condition, decision variables, limiting conditions, number of degrees of freedom, program, allowed program, optimal program, linear program. in the general form and in the notation of the matrix calculus.

2. Writing a linear programming problem in a vector-matrix form. Overview of the method of determining base solutions.

3. The Primal Simplex algorithm, with an example where a problem has one solution.

4. The Primal Simplex algorithm with an example, when the problem has no solution or has an infinite number of solutions.

5. The transportation problem is balanced, taking into account the limitations. Discussion of the mathematical model corresponding to the notation of linear programming. Introduction of the transport table. Overview of the cost minimization method.

6 Transportation algorithm with examples. Including unbalanced transport issues.

7. The question of allocation and the Hungarian algorithm.

8. Minimizing empty waveforms or quotient programming (optional).

Lab:

1. Discussion of the graphic method for solving problems in which the objective function is a function of two variables.

2. Describing tasks with content (concerning, for example, business analysis, diet issues, optimal selection of the production assortment, waste minimization) in the form of a mathematical model. The use of software to solve problems graphically when the problem has one solution.

3. Application of the graphical method, discussion of examples when the task has an infinite number of solutions or there is no optimal solution.

4. Saving tasks with content (concerning, for example, issues of mixtures, selection of the production assortment, selection of technological processes) using a mathematical model. Solving tasks using the software (optional: MatLab using the linprog or Solver functions of the Excel package). Overview of the operation of the selected program.

5. Saving transport problems in the form of a mathematical model of linear programming, to obtain solutions - using the software used.

6. Recording transport issues (concerning the assignment of people to positions) with a mathematical model, taking into account the example of unbalanced tasks. Using the software used to obtain complete solutions (with values 0 or 1). Overview of restricted transport tasks.

7. Solving the problems of minimizing empty waveforms or quotient programming (optional).

Teaching methods

Lecture: multimedia presentation illustrated with examples given on the board, solving problems.

Laboratory: solving a set of tasks with the use of appropriate software, interpretation of obtained results

Bibliography

Basic

1. M. Simonnard, „Programowanie liniowe”, PWN, 1967,

2. Zb. Jędrzejczyk, K. Kukuła, J.Skrzypek, A. Walkosz, „Badania operacyjne w przykładach i zadaniach", PWN, 2004,

3. Maciej M. Sysło, Narsingh Deo, Janusz S. Kowalik, „Algorytmy optymalizacji dyskretnej" PWN 1999

Additional

1. Edmund Ignasiak, „Badania operacyjne" PWE 2001,

2. Andrzej Cegielski, „Programowanie liniowe", cz.1, Zielona Góra 2002,

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests) [1]	20	1,0

[1] delete or add other activities as appropriate