# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Operational Research and Econometrics

## Course

Field of study
Engineering Management

Year/Semester
1/1

Area of study (specialization)
Managing Enterprises of the Future

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)

Tutorials
15

Projects/seminars

## Number of credit points

4

## Lecturers

Responsible for the course/lecturer:
Ph.D., Tomasz Brzęczek

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Responsible for the course/lecturer:
Ph.D., Eng. Andżelika Libertowska

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## Prerequisites

algebra rules, basics of probability theory and statistics, operaiting skills in Excel and its formulas

## Course objective

Learning to plan and make quantitative and other decisions using methods of constrained optimization. Learning methods of economic relations estimation and applications.

## Course-related learning outcomes

Knowledge

1. Student knows typical problems of operation management, analyzes and solves tasks [P7S_WG_02].

2. Knows graphical method and simplex for linear programming [P7S_WG_04].

3. Knows chosen optimization methods for multicriteria problems, graphs and networks solving [P7S_WG_08].

4. Knows statistics used to assess decisions and risk, knows rules used under uncertainty [P7S_WG_02].

5. Knows ordinary least squares method, its assumptions, properties and applications [P7S_WG_03].

Skills

1. Student can solve optimization tasks using Excel Solver add-in [P7S_UW_01; _03].

2. Understands idea of graphical method and simplex algorithm [P7S_UW_04].

3. Can identify multi criteria decision tasks and problems that are solved with graph theory [P7S_UW_06].

4. Can optimize decision under risk and limit the level of risk [P7S_UW_06].

5. Can estimate econometrics model, can assess significancy, goodness of fit and analyse results. In particular estimates costs model due to quantity of one or many products and sales trend [P7S_UW_02].

Social competences

Is able to persuade mangement practicioners to benefits of optimization and modelling usage [P7S_KK_01-02; P7S_KO_01].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Partial assessment:

a) at lecture the modelling and classifing study of optimization case is assessed,

b) at tutorial there is intrasemester assessment of tasks solving and theory answering.

c) at laboratory current outcomes are assessed

Final grade:

a) at lecture results from whole semester course test including open and closed questions about theory and problems to be analysed.

b) at tutorial solving tasks from topics of second half of semester

c) at laboratory – a group of 2 students use Solver to find out the optimum solution of a case.

## Programme content

1. linear programmes (LP) formulation: product assortment, blending problem, transportation and transshipment, multiperiod scheduling, using of Excel add-in Solver

2. linear programming. simplex, graphical methods, sensitivity analysis,

3. transportation and transshipment problem, balanced, unbalanced supply-demand,

4. descrete multigoal tasks and methods, multigoal optimality, ranks, optimization degree, AHP,

5. decisions under uncertainty and risk: strategies, news boy, decision tree, spare parts stock,

6. estimation of an econometric model with ordinary least squares, assessment of significancy and goodness of fit, and forecasing and forecast expected error calculus.

## Teaching methods

lecture focused at problem, tutorial in solving tasks, case study

## Bibliography

Basic

1. Anholcer M., Gaspars H., Owczarkowski A., Ekonometria z Excelem, Wyd. UEP, Poznań 2010.

2. Brzęczek T., Gaspars-Wieloch H., Godziszewski B., Podstawy badań operacyjnych i ekonometrii, Wyd. PP, Poznań 2010.

3. Przykłady i zadania z badań operacyjnych i ekonometrii, Sikora W. (red.), Wyd. UEP, MD, Poznań 2005.

4.Balakrishnan N., Render B., Stair RM. (2011), Managerial Decision Modeling with Spreadsheets, Pearson Education

Additional

1. Józefowska J., Badania operacyjne i teoria optymalizacji, Wydawnictwo PP, Poznań 2011.

2. Sikora W. (red.), Badania operacyjne, PWE, Warszawa 2008.

3. Trzaskalik T. (red.), Wprowadzenie do badań operacyjnych z komputerem + CD, PWE, Warszawa 2008.

4. Brzęczek T., Nowak D. (2013), Genetic Algorithm Modification for production scheduling. Fondations of Computing and Decision Sciences 4:299-3092; 2. Ugurlu K., Brzęczek T. (2023). Distorted probability operator for dynamic portfolio optimization in times of socio-economic crisis. Central European Journal of Operations Research, vol. 31(4):1043-1060

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 100 | 4,0 |
| Classes requiring direct contact with the teacher | 45 | 2,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests, teams prepare assigned cases solutions) [1] | 55 | 2,0 |

[1] delete or add other activities as appropriate