COURSE DESCRIPTION CARD - SYLLABUS

Course name
Operational Research and Econometrics [N2IZarz1>BOiE]

Course

Field of study
Engineering Management

Year/Semester
1/1

Area of study (specialization)
Enterprise Resource and Process Management

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
12

Laboratory classes
0

Other (e.g. online)
0

Tutorials
12

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr Tomasz Brzęczek
tomasz.brzeczek@put.poznan.pl

Lecturers

dr inż. Andżelika Libertowska
andzelika.libertowska@put.poznan.pl

Prerequisites

none

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 explain benefits of optimization in practice [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 and theory.
Final grade:
a) of lecture results from final test including tasks and problem questions.
b) of tutorial - a group of 2 students use Solver to find out the optimum solution of a case different than the chosen one for partial assessment a) .

Programme content

The course of Operations Research and Econometrics covers for linear programming (LP), including sensitivity analysis of the optimal solution. Basic balanced and unbalanced transportation problem are presented.
The course concerns uncertainty and stochastic programming of decisions under risk. Ocasionally, is taught only general understanding of multicriteria decisions and other issues like project time-cost analysis. There is separated block of econometrics for linear regression model with ordinary least squares estimation. , assessment of significancy and
goodness of fit, and forecasing and forecast expected error calculus.

Course topics

Lecture intoduces the theory and methods of OR programming graphically the optimal production assortment. Simplex is mentioned as well as transportation problems. Uncertainty and risk of decision with payoff and decision tree. Lecturer solves MaxiMin, MaxiMax, Hurwicz, Bayes and Savage (regret) decision rules. Lectured econometrics covers for OLS estimation of linear regression with one or more independent variables.
At tutorials we solve linear problems. In particular, we graphically solve assortment optimization problem. We balance demand with supply and find feasible shipment solution with North-West corner method. The optimal solution check is done with software and Internet solvers. We solve decision tree. We analyze the case of regerssion model and forecast.
Laboratory starts with solving optimum product-mix(assortment) using MS Solver. Reading a report from sensitivity analysis. Assessment of the optimum uniqueness, reduced cost, unit profit and resource limit change. We solve transportation problem and decision tree in Excel. Supplementary tasks analyzed are: CPM in project time analysis, multiperiod scheduling and linear regression.

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. Gruszczyński M., Kuszewski T., Podgorska M. (red. nauk.), Ekonometria i badania operacyjne,

Wydawnictwo Naukowe PWN, Warszawa, 2022.
5. Sikora W. (red.), Przykłady i zadania z badań operacyjnych i ekonometrii, Wydawnictwo UEP, Poznań, 2005.
6. Trzaskalik T. (red.), Wprowadzenie do badań operacyjnych z komputerem - CD, PWE, Warszawa, 2008.

Additional:
1. Jóźefowska J., Badania operacyjne i teoria optymalizacji, Wydawnictwo PP, Poznań 2011.
2. Sikora W. (red.), Badania operacyjne, PWE, Warszawa 2008.
3. 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	4,00
Classes requiring direct contact with the teacher	25	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	75	3,00