

# Operations Research - opis przedmiotu

Informacje ogólne	
Nazwa przedmiotu	Operations Research
Kod przedmiotu	06.9-WM-ER-ZiIP-20_18
Wydział	Wydział Nauk Inżynieryjno-Technicznych
Kierunek	WM - oferta ERASMUS
Profil	-
Rodzaj studiów	Program Erasmus
Semestr rozpoczęcia	semestr zimowy 2023/2024

Informacje o przedmiocie	
Semestr	2
Liczba punktów ECTS do zdobycia	5
Typ przedmiotu	obowiązkowy
Język nauczania	angielski
Sylabus opracował	<ul style="list-style-type: none"><li>prof. dr hab. Taras Nahirnyy</li><li>dr inż. Tomasz Belica</li></ul>

Formy zajęć					
Forma zajęć	Liczba godzin w semestrze (stacjonarne)	Liczba godzin w tygodniu (stacjonarne)	Liczba godzin w semestrze (niestacjonarne)	Liczba godzin w tygodniu (niestacjonarne)	Forma zaliczenia
Wykład	30	2	-	-	Egzamin
Projekt	30	2	-	-	Zaliczenie na ocenę

## Cel przedmiotu

Transfer of basic knowledge and acquisition by students of skills and competences in the field of operations research, which will be used in the further education process and useful in future professional work.

## Wymagania wstępne

Basic Mathematics Course, Information Technology.

## Zakres tematyczny

### Lecture content

- L1. Preliminary issues. Basic elements and problems of operational research. Linear programming problem. Geometric method of solving the problem LP.
- L2. Simplex method.
- L3. Two-phase method and Big M method. Problems with Simplex.
- L4. Duality and sensitivity analysis. The Dual Simplex Method.
- L5. The Transportation Problem.
- L6. The Assignment and Traveling Salesman Problems.
- L7. Integer Programming. Gomory's cutting plane algorithm and the Branch-and-Bound Technique.
- L8. Network analysis. Basic concepts of graphs. The Terminology of Networks.
- L9. Shortest Path Method. Applications in technology.
- L10. Project management technique. Critical path method. CPM and the Gantt chart.
- L11. Time-cost analysis. PERT method. Computer aided network analysis.
- L12. Components and classification of queuing systems. Kendal notation. Little's laws. Rate diagram for the birth and death process. Laws for constructing a system of equations.
- L13. A single-channel system with an exponential distribution of service time and the arrival streams. Applications.
- L14. Multi-channel system with a simple fluxes. Simple Streams. Applications.
- L15. Computer-aided research of queuing systems. Final remarks.

### Project

P1. Presentation of the course program, learning outcomes and assignment conditions. Characteristics of individual topics carried out during the project classes.

P2-3. Geometric method of solving the linear programming problem.

P4-9. Simplex Methods - maximisation and minimisation case, simplex algorithm, dual simplex method, big M method. OFC (Objective Function Coefficient) and RHS (Right Hand Side) sensitivity analysis. Integer programming.

P10-11. The transportation problem, formulation and types. The transportation problem, formulation and types. Methods of generating the basic solution. Optimization of the basic solution. Degeneracy in the transportation problem.

P12. The assignment problem.

P13-14. Project planning and scheduling - CPM and PERT techniques.

P15. Summary of completed problems. Completion of the project classes.

## Metody kształcenia

Conventional lecture..

Project - individual and group work of students using literature and lecture notes.

## Efekty uczenia się i metody weryfikacji osiągnięcia efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
The student has knowledge of linear programming, integer programming / discrete optimisation, network methods and queuing systems which are useful for formulating and solving simple, manufacturing engineering tasks.		<ul style="list-style-type: none"><li>egzamin - ustny, opisowy, testowy i inne</li><li>obserwacja i ocena aktywności na zajęciach</li><li>praca pisemna</li></ul>	<ul style="list-style-type: none"><li>Wykład</li><li>Projekt</li></ul>
The student is able to make a preliminary, economic analysis of the engineering activities undertaken, based on solutions to the relevant, operational research issues.		<ul style="list-style-type: none"><li>egzamin - ustny, opisowy, testowy i inne</li><li>praca pisemna</li></ul>	<ul style="list-style-type: none"><li>Wykład</li><li>Projekt</li></ul>
The student is able to interact and work in a group		<ul style="list-style-type: none"><li>aktywność w trakcie zajęć</li></ul>	<ul style="list-style-type: none"><li>Projekt</li></ul>
The student has a knowledge of the branch of operational research and of the numerical methods used in the formulation and solving of simple tasks, related to management and production engineering.		<ul style="list-style-type: none"><li>bieżąca kontrola na zajęciach</li><li>egzamin - ustny, opisowy, testowy i inne</li><li>praca pisemna</li></ul>	<ul style="list-style-type: none"><li>Wykład</li><li>Projekt</li></ul>
The student is able to obtain information from literature and other properly selected sources, is able to integrate and interpret obtained informations.		<ul style="list-style-type: none"><li>obserwacje i ocena umiejętności praktycznych studenta</li></ul>	<ul style="list-style-type: none"><li>Projekt</li></ul>
The student is able to produce a well-documented paper on the use of operational research in manufacturing engineering.		<ul style="list-style-type: none"><li>praca pisemna</li></ul>	<ul style="list-style-type: none"><li>Projekt</li></ul>
The student understands the need for life-long learning.		<ul style="list-style-type: none"><li>obserwacja i ocena aktywności na zajęciach</li></ul>	<ul style="list-style-type: none"><li>Projekt</li></ul>

## Warunki zaliczenia

**Lecture:** exam

Grade based on a written exam that verifies the knowledge of basic issues.

**Project:** graded credit

The grade is determined on the basis of the component evaluating skills related to the implementation of project tasks, preparation of reports and the component for "defense" by the student of individual reports.

**Final grade:** arithmetic average of grades from the above-mentioned forms of classes.

## Literatura podstawowa

- Hillier F.S., Lieberman G.J., Introduction to Operations Research, McGrawHill, 2015.
- Dantzig, George B., Thapa, Mukund N., Linear Programming 2: Theory and Extensions, Springer, 2003.
- Thomopoulos N.T.: Fundamentals of Queuing Systems, Springer, New York, 2012.
- P. Rama Murthy: Operations Research, New Age International Publishers, 2007.
- Wayne L. Winston: Operations Research. Applications and algorithms. Thomson Brooks/Cole, 2004.
- Electronic help of programs

## Literatura uzupełniająca

1. Halidi Lyeme, Mohamed Seleman: Introduction to Operations Research: Theory and Applications. LAP LAMBERT Academic Publishing, 2012.
2. Ignasiak E. (red.), Badania operacyjne, PWE, Warszawa, 2001. (in Polish)
3. Kukuła K. (red.), Badania operacyjne w przykładach i zadaniach, Warszawa, PWN, 2001. (in Polish)

## Uwagi

Zmodyfikowane przez dr inż. Tomasz Belica (ostatnia modyfikacja: 06-02-2024 18:42)

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