SYLLABUS OF A MODULE

Polish name of a module	**Wybrane zagadnienia zastosowań matematyki**
English name of a module	**Selected problems of applied mathematics**
ISCED classification - Code	0541
ISCED classification - Field of study	*Mathematics*
Languages of instruction	*English*
Level of qualification:	*2*
Number of ECTS credit points	*4*
Examination:	*A*
Available in semester:	*S*

Number of hours per semester:

Lecture	Tutorial	Laboratory	Seminar	Project	Others
30	0	15	0	0	0

MODULE DESCRIPTION

Module objectives

O1. Making the students familiar with the elements of the theory and major algorithms of mathematical programming

O2. Acquaint students with practical skills to formulate, solve and interpret solutions to problems in the field of mathematical programming, in particular the linear and nonlinear programming

O3. Introducing the students into using the computer implementation of the presented algorithms and the use of the presented optimization packages

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Course of elementary algebra, in particular matrix calculus
2. Course of the calculus of one and several variables (course of the

mathematical analysis)

LEARNING OUTCOMES

LO 1 – student is familiar with the basic theory of mathematical programming

LO 2 – student is able to independently formulate and solve mathematical programming problems, is able to give them the proper practical interpretation

LO 3 – student is familiar with presented optimization packages and is able to use it in solving the mathematical programming problems

MODULE CONTENT

Type of classes – Lectures		**Number of hours**
Lect. 1	Course introduction. Matrices and matrix operations.	**2**
Lect. 2	System of linear equations.	**2**
Lect. 3	Introduction to the field of mathematical programming. Basic concepts and notation. Examples of practical optimization problems. Formulating the problem and constructing a mathematical model.	**2**
Lect. 4	The linear programming model. Solving linear programming problems: the Simplex method.	**2**
Lect. 5	Duality theory.	**2**
Lect. 6	Transportation problem.	**2**
Lect. 7	Nonlinear programming problems. Convex sets, convex and nonconvex functions, applications in nonlinear problems.	**2**
Lect. 8	Types of nonlinear programming problems. The necessary and sufficient conditions for optimality	**2**
Lect. 9	The Kuhn – Tucker theorem, conditions for constrained optimization.	**2**
Lect. 10, 11	Quadratic programming.	**4**
Lect. 12	Introduction to network analysis. The basic terminology of networks and graphs.	**2**

Lect. 13, 14	Project planning and control with PERT - CPM.	**4**
Lect. 15	Achievement test	**2**
Type of classes– Laboratory		**Number of hours**
Lab.1, 2	Matrix operations. Appplication of the Gauss – Jordan method for solving system of linear equations. Maple introduction.	**2**
Lab.3, 4	Formulating the mathematical model for linear problems, primal-dual relationship.	**2**
Lab.5	Application of the Simplex method	**1**
Lab.6, 7	A streamlined Simplex method for transportation problem.	**2**
Lab.8, 9	Formulating the mathematical model for nonlinear problems, formulating and testing the conditions for optimality	**2**
Lab.10, 11	Formulating the Lagranga'e function, solving the nonlinear programming problem using the optimization packages.	**2**
Lab.12, 13	A few kind of network problems, methods of solution.	**2**
Lab.14,	PERT and CPM method.	**1**
Lab.15	Final project.	**1**

TEACHING TOOLS

1. – lectures using multimedia presentations
2. – tutorials

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE)

F1. – assessment of preparation for classes
F2. – assessment of the ability to apply acquired knowledge during labolatory exercises and project
F3. – assessment of activity during all types of classes
S1. – assessment of the ability to solve the posed problems and the method of presentation of the obtained results - credit for the grade
S2. – assessment of mastery of the lecture material - passing the lecture (test)

STUDENT'S WORKLOAD

L.p.	**Forms of activity**	**Average number of hours required for realization of activity**
1.	**Contact hours with teacher**	
1.1	Lectures	30
1.2	Tutorials	0
1.3	Laboratory	15
1.4	Seminar	0
1.5	Project	0
Total number of contact hours with teacher:		45
2.	**Student's individual work**	
2.1	Preparation for tutorials and tests	0
2.2	Prreparation for laboratory exercises, writing reports on laboratories	16
2.3	Preparation of project	0

2.4	Preparation for final lecture assessment	15
2.5	Preparation for examination	0
2.6	Individual study of literature	24
Total numer of hours of student's individual work:		55
Overall student's workload:		100
Overall number of ECTS credits for the module		4
Number of ECTS points that student receives in classes requiring teacher's supervision:		1,8
Number of **ECTS** credits acquired during practical classes including laboratory exercises and projects :		0,6

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Lecture notes
2. Hillier F., S., Lieberman G., J., Introduction to operations research, McGraw-Hill, Inc. 2001
3. Polyanin A. D., Manzhirow A., V., Mathematics for engineers and scientists, Chapman & Hall/CRC, 2007
4. Forst W., Hoffman D., Optimization – Theory and Practice, Springer Science + Business Media, 2010

MODULE COORDINATOR (NAME, SURNAME, INSTITUTE, E-MAIL ADDRESS)

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