SYLLABUS OF A MODULE

Polish name of a module	**Wprowadzenie do programowania matematycznego**
English name of a module	**Introduction to mathematical programming**
ISCED classification - Code	0541
ISCED classification - Field of study	*Mathematics*
Languages of instruction	*English*
Level of qualification: ***1 – BSc (EQF 6)*** ***2 – MSc (EQF 7)*** ***3 – PhD (EQF 8)***	*1*
Number of ECTS credit points	*6*
Examination: ***EO – exam oral*** ***EW – exam written*** ***A - assignment***	*A*
Available in semester: ***S – Spring only*** ***A – autumn only*** ***Y - both***	*A*

Number of hours per semester:

Lecture	Exercises	Laboratory	Seminar	E-learning	Project
30	0	30	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. Acquainting the students with practical skills to formulate, solve and interpret solution to problems in the field of mathematical programming, in particular linear programming

O3. Introducing the students in the use of 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 mathematical analysis)
3. Ability to use different sources of information
4. Ability to work both independently and in a group
5. Ability to correctly interpret and present student's own activities

LEARNING OUTCOMES

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

LO 2 – student is able to independently formulate and solve the mathematical programming problems, and 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**
Lec 1 – Course introduction. Matrices and matrix operations	**2**
Lec 2 – System of linear equations.	**2**
Lec 3, Lec 4 – Introduction to the field of mathematical programming. Basic concepts and notation. Examples of practical problems in the field of mathematical programming. Formulating the problem and constructing a mathematical model.	**4**
Lec 5, Lec 6, Lec 7 – The linear programming model. Solving linear programming problems: graphical method, Simplex method.	**6**
Lec 8 – Duality theory and sensitivity analysis.	**2**
Lec 9, Lec 10 – Transportation problem. The transportation Simplex method.	**4**
Lec 11, Lec 12 – Integer programming. The branch and bound method.	**4**
Lec 13– Introduction to network analysis. The basic terminology of networks and graphs.	**2**
Lec 14, Lec 15 – Project planning and control with PERT - CPM.	**4**
Type of classes – Tutorials	**Number of hours**
T1, T2 – Matrix operations. Application of the Gauss – Jordan method for solving system of linear equations. Maple introduction.	**4**
T3, T4 – Formulating the mathematical model for linear problems, primal-dual relationship. Sensitivity analysis.	**4**
T5, T6 – The graphical and Simplex method with Maple.	**4**
T7, T8 – A streamlined Simplex method for transportation problem.	**4**
T9 – Transshipment and assignment problems.	**2**
T10, T11 – Integer programming problems, the branch and bound method.	**4**
T12, T13 – A few kind of network problems, methods of solving these problems.	**4**
T14– PERT and CPM method.	**2**
T15 – Test	**2**

TEACHING TOOLS

1. – lecture with using multimedia presentations
2. – tutorials

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. - assessment of preparation for laboratory exercises
F2. - assessment of the ability to apply the acquired knowledge while doing the exercises

F3. - evaluation of reports on the implementation of exercises covered by the curriculum
F4. - assessment of activity during classes
S1. - assessment of the ability to solve the problems posed and the manner of presentation obtained results - pass mark *

*) in order to receive a credit for the module, the student is obliged to attain a passing grade in all laboratory classes as well as in achievement tests.

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	
1.3	Laboratory	30
1.4	Seminar	
1.5	Project	
1.7	Examination	
	Total number of contact hours with teacher:	60
2.	**Student's individual work**	
2.1	Preparation for tutorials and tests	
2.2	Preparation for laboratory exercises, writing reports on laboratories	40
2.3	Preparation of project	
2.4	Preparation for final lecture assessment	20
2.5	Preparation for examination	
2.6	Individual study of literature	20
	Total number of hours of student's individual work:	80
	Overall student's workload:	140
Overall number of ECTS credits for the module		6
Number of ECTS points that student receives in classes requiring teacher's supervision:		2,4
Number of **ECTS** credits acquired during practical classes including laboratory exercises and projects :		1

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, DEPARTMENT, E-MAIL ADDRESS)

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