FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Techniki optymalizacji**
Name in English:	**Optimisation techniques**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Renewable Energy Sources**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**optional**
Subject code:	**ELR051317**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		15		
Number of hours of total student workload (CNPS):	30		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. A basic knowledge of the properties of functions, calculus of functions of several variables, linear algebra.

SUBJECT OBJECTIVES

C1. Transfer of the basic knowledge and skills necessary for the proper formulation of optimization problems.
C2. Introduction to the basic methods of solving optimization problems.
C3. Training the skills in practical use of common software for solving optimization problems.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 knows the rules of mathematical formulation of the optimization problems.
PEU_W02 knows basic mathematical theorems on extreme functions of several variables, including the presence of constraints.
PEU_W03 knows the basic methods and algorithms for solving linear and nonlinear optimization tasks.

relating to skills:

PEU_U01 able to formulate a mathematical model of the optimization problem.
PEU_U02 able to select and use available software to solve optimization problems and correctly interpret the results.

relating to social competences:

PEU_K01 able to think and act in a creative and enterprising way.

PROGRAMME CONTENT

	Form of classes - lecture	Number of hours:
Lec 1	Introduction. Basic concepts. The objective function, constraints, parameters. Optimisation problem formulation. Examples of problems.	2
Lec 2	Unconstrained problems. Optimality conditions for unconstrained problems.	2
Lec 3	Unconstrained minimization techniques. The steepest descent method. The Newton methods.	2
Lec 4	Conjugate gradient. Levenberg-Marquardt method. Non-gradient methods.	2
Lec 5	Nonlinear constrained optimisation. Equality and inequality constraints. Kuhn-Tucker conditions.	2
Lec 6	Lagrangian function. Lagrangian duality.	2
Lec 7	Linear programming.	2
Lec 8	Final test.	1
	Total hours:	**15**

Form of classes - laboratory		Number of hours:
Lab 1	H&S regulations. Laboratory working rules. Rules for working in a group. Rules for final crediting.	1
Lab 2	Constructing a mathematical model of an optimization problem. Analytical determination of the extremum of a function.	2
Lab 3	The study of numerical methods for unconstrained problems.	2
Lab 4	The study of numerical methods for unconstrained problems.	2
Lab 5	The study of numerical methods for unconstrained problems.	2
Lab 6	The study of numerical methods for unconstrained problems.	2
Lab 7	Applying the Optimization Toolbox of Matlab.	2
Lab 8	Applying the Optimization Toolbox of Matlab.	2
	Total hours:	**15**

TEACHING TOOLS USED
N1. Lecture with multimedia presentations. N2. Computer laboratory suitable for group working.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02 PEU_W03	Final test.
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Grading the correctness of optimization problem solutions.
P(L)	P=F1	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Podstawy optymalizacji, A. Stachurski, A. P. Wierzbicki, WPW 1999 [2] Metody rozwiązywania zadań optymalizacji, J. Seidler, A. Badach, W. Molisz, WNT 1980 **SECONDARY LITERATURE:** [1] Teoria i metody obliczeniowe optymalizacji, W. Findensein, J. Szymanowski, A. Wierzbicki, PWN 1977 [2] Podstawy optymalizacji, F. Milkiewicz, Politechnika Gdańska 1995 [3] Practical Optimization Methods, M. Asghar Bhatti, Springer-Verlag 2000

SUBJECT SUPERVISOR
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