DESCRIPTION OF THE COURSES

- Course code: ARR1307
- Course title: Optimisation techniques
- Language of the lecturer: Polish

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*2*	*0*	*1*		
*Number of hours/semester**					
Form of the course completion	*exam*		*problem tutorials*		
ECTS credits	*4*		*2*		
Total Student's Workload	*120*		*60*		

- Level of the course (basic/advanced): advanced
- Prerequisites: Advanced calculus
- Name, first name and degree of the lecturer/supervisor: Zbigniew Wacławek, Ph.D.,
- Names, first names and degrees of the team's members:

1. Paweł Kostyła, Ph.D., B.Ing
2. Zbigniew Leonowicz, Ph.D., B.Ing
3. Jarosław Szymańda, Ph.D., B.Ing
4. Piotr Ruczewski, Ph.D., B.Ing

- Year:..I..... Semester:.....1.....
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course):

Ability of optimisation algorithms implementation for constrained and unconstrained problems. Skills of standard procedures and genetic algorithms applications.

- Form of the teaching (traditional/e-learning): traditional
- Course description:

Classification of optimisation problems. Optimisation problem formulation; examples. Mathematical models. Unconstrained and constrained problems. Solution of optimisation problems: mathematical preliminaries, numerical methods. Kuhn-Tucker conditions. Lagrangian duality. Selected algorithms for constrained optimisation. Linear programming, the simplex method. Integer optimisation. Genetic algorithms

- Lecture:

Particular lectures contents	*Number of hours*
1. Introduction. Optimisation problem formulation. Classification of problems. The standard form of an optimisation problem. Objective function and optimisation variables. Examples.	4.0
2. Mathematical preliminaries. Vectors and Matrices. Elements of differential calculus. Convex sets and functions.	2.0
3. Unconstrained problems. Optimality conditions for unconstrained problems.	2.0

4. Unconstrained minimization techniques. The steepest descent method. Conjugate gradient. The Newton methods.	4.0
5. One-dimensional search methods. Golden section search.	2.0
6. Nonlinear constrained optimisation. Kuhn-Tucker conditions.	2.0
7. Lagrangian function. Lagrangian duality.	2.0
8. Penalty methods.	2.0
9. Linear programming.	2.0
10. The simplex method.	2.0
11. Integer optimisation.	2.0
12. Genetic algorithms.	2.0

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:

Optimisation problem formulation, mathematical models of problems. Analytical minimization techniques. Numerical methods: the steepest descent, conjugate gradient, the Newton methods. Linear programming. The application of MATLAB Optimization Toolbox

- Project – the contents:
- Basic literature:

1. Podstawy optymalizacji, A. Stachurski, A. P. Wierzbicki, WPW 1999
2. Metody rozwiązywania zadań optymalizacji, J. Seidler, A. Badach, W. Molisz, WNT 1980

- Additional literature:

1. Teoria i metody obliczeniowe optymalizacji, W. Findensein, J. Szymanowski, A. Wierzbicki, PWN 1977
2. Podstawy optymalizacji, F. Milkiewicz, Politechnika Gdańska 1995
3. Zasady automatyki, J. Pułaczewski, K. Szacka, A. Manitus, WNT 1974
4. Programowanie nieliniowe, B. Martos, PWN 1983
5. Practical Optimization Methods, M. Asghar Bhatti, Springer-Verlag 2000

- Conditions of the course acceptance/credition: All laboratory classes credited and lecture-related written test passed.

* - depending on a system of studies