DESCRIPTION OF THE COURSES

- Course code: ELR1310
- Course title: NUMERICAL AND OPTIMIZATION METHODS
- Language of the lecturer: ENGLISH

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*1*		*1*		
*Number of hours/semester**	*15*		*15*		
Form of the course completion	*w r i t t e n test*		*reports*		
ECTS credits	*2*		*1*		
Total Student's Workload	*60*		*30*		

- Level of the course (basic/advanced): basic
- Prerequisites: Mathematics, Matlab course
- Name, first name and degree of the lecturer/supervisor: Leonowicz Zbigniew, PhD
- Names, first names and degrees of the team's members:

1. Wacławek Zbigniew , PhD
2. Janik Przemysław, PhD

- 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:

The course contains theoretical and practical aspects of solving 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, simplex method. Neural networks & Genetic algorithms for optimization.

- 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.	*2*
2. Mathematical preliminaries. Vectors and Matrices. Elements of differential calculus. Convex sets and functions.	*1*
3. Unconstrained problems. Optimality conditions for unconstrained problems.	*1* *2*
4. Unconstrained minimization techniques. The steepest descent method. Conjugate gradient. The Newton methods.	*1*

5. . One-dimensional search methods. Golden section search.	*2*
6. Nonlinear constrained optimisation. Kuhn-Tucker conditions. Lagrangian function. Lagrangian duality.	*3*
7. Penalty methods. Linear programming. Integer optimisation.	*3*
8. Genetic algorithms. Neural networks.	

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:
  1. Optimisation problem formulation, mathematical models of problems.
  2. Analytical minimization techniques.
  3. Numerical methods: the steepest descent, conjugate gradient, the Newton methods.
  4. Linear programming.
  5. The application of Matlab Optimization Toolbox.
- Project – the contents:
- Basic literature:

[1] E.K.P. Chong, S.H. Żak: An Introduction to Optimization, 2nd edition, New York, John Wiley, 2001.

[2] J.F. Bonnans: Numerical optimization: theoretical and practical aspects, Springer-Verlag, 2003.

[3] M. Asghar Bhatti: Practical Optimization Methods, Berlin, Springer-Verlag 2000.

- Additional literature:
- Conditions of the course acceptance/credition: Written test.

***** - depending on a system of studies