Course name	**Optimisation methods**	*Code*	VI.3.	*Credit points*	**3** (all**)**

Language of instruction **English**

Programme Computer Modelling and Simulation (CMS), Intelligent Energy (IE), Biotechnology for Environmental Protection (BI), Bussines and Technology (BT)

Type of studies BSc studies

Unit running the programme Institute of Thermal Machinery (Instytut Maszyn Cieplnych)

Course coordinator and academic teachers Dr inż. Maciej Marek (lectures and laboratory classes)

Form of classes and number of hours

Semester	Lec.	Tut.	Lab.	Proj.	Sem.	Credit points
3	30	-	15	-	-	3

Learning outcomes

The objectives of this course are designed to introduce fundamental optimisation methods in a general framework with examples in engineering and economics.
The students will learn the most important characteristics of some popular methods and how to use them in practice. During laboratory classes they will employ a computational tool (AMPL) together witch analytical methods for solution of example problems.

Prerequisites Basic knowledge of differential calculus, matrix and vector algebra

Course description

LECTURE

Fundamental concepts in optimisation: mathematical models, types and methods of optimisation (2). Application of differential calculus in optimisation – problems of one and many variables (4). Constrained optimisation: Lagrange multipliers (2). Kuhn-Tucker conditions (2). Linear programming: Simplex method (2). Iterative methods for unconstrained problem: direct and descent methods (4). Other iterative methods: random algorithms, sequential linear programming, method of feasible directions (2). Penalty function method: Kelley's and Caroll's methods (2). Multiobjective optimisation (2). Dynamic programming: formal statement, fundamental recursive equation, (2).Other optimisation methods: genetic algorithms, simulated annealing, neural networks (2). Examples of practical optimisation problems in energy engineering – optimum pipe diameter, two-stage compressor, drying of sugar, computational fluid dynamics (2). A Mathematical Programming Language (AMPL) (2).

TUTORIALS:

Not applicable

	LABORATORY Formal statement of optimisation problems (2). Analytical methods in optimisation (differential calculus, Lagrange multipliers, Kuhn-Tucker conditions) (2). Introduction to AMPL (2). Solution of engineering and economical problems with AMPL (4). Penalty function method (2). Multiobjective optimisation (3). PROJECT Not applicable SEMINAR Not applicable
Form of assessment	Written test (lecture material), assignment in AMPL (lab.)
Basic reference materials	1. Singiresu S. Rao: Engineering optimization. A Wiley-Interscience Publication John & Sons, Inc. New York 1996 2. Bhatti M. Asghar: Practical optimisation methods. Springer-Verlag New York Berlin Heidelberg 2000. 3. Gill P.E., Murray W., Wright M.H.: Practical optimization. Academic Press, San Diego-San Francisco-New York-Boston-London-Sydney-Tokyo, Twelfth printing 2000.
Other reference materials	For Polish-speaking students: 1. Kusiak J.: Optymalizacja, PWN, Warszawa, 2009 2. Popov S. O.: Metody numeryczne i optymalizacja. Politechnika Szczecińska, Szczecin, 1999 3. Sieniutycz, S.: Optymalizacja w inżynierii procesowej, WNT, 1978

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Average student workload per week (teaching hours + individ.)	3 teaching hours + 1 hours of individual work
Remarks:	
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