Course title:	**Optimisation of industrial processes**
Lecturer:	Assoc. Prof. Nenad Bolf, Ph.D.
Course Type:	Elective
ECTS:	6
Total Hours:	30 hours
Content of the Course:	Methodology and application of optimisation methods. Selection of optimisation methods and criteria. Elaboration of optimisation algorithms and programme development. Methods of unconstrained parameter optimisation. Methods of constrained parameter optimisation. Determination of local and global optimum. Optimisation by artificial intelligence methods and heuristic methods. Multi-criteria optimisation. Programme packages for optimisation. Examples of practical applications.
Competences:	Knowledge of basic methods of local and global optimisation. Working skills with a number of programme tools for optimisation. Acquisition of knowledge and skills in application of methods to specific industrial problems.
Teaching Methodology:	Lectures and seminars. The application of software systems Excel Solver, Statistica, Matlab and PiControl Solutions. Auditory and information technology seminars.
Course Units:	Optimisation: significance and role in chemical process industry. Introduction into optimisation methods. The objective function, variables of determination, constraints. Overview of gradient and non-gradient methods of optimisation. The golden ratio method; Quadratic polynomial method; Newton's method and its modifications. The basics of linear programming. Nelder-Mead, Downhill, Simplex method. Powell's method. Local and global optima. Deterministic algorithms of global optimisation. Hooke-Jeeves' pattern search method. The method of branching and bounds. Multi-criteria optimisation (Method of weighted sums and Pareto analysis). Evolutionary algorithms. The basics of simulated annealing method. The basics of fuzzy optimisation. Statistical optimisation methods. The basics of pattern theory: arithmetic mean pattern distribution, unbiased and interval estimates, standard error. Student's t-distribution. Testing of statistical hypotheses. The correlation and regression analysis: pattern correlation coefficient, pattern correlation distribution. Linear and nonlinear regression, method of minimizing root mean square deviation. The variance analysis and F-test. Software tools: outline and characteristics. Statistica, Excel Solver, Matlab and PiControl Solutions.
Examination method:	Seminar, oral exam
References:	1. P. Venkataraman, Applied optimization with MATLAB Programming; John Wiley and Sons, New York, 2009. 2. D.G. Luenberge, Linear and Nonlinear Programming, 2nd Edition, Springer, 2003. 3. E.M.T. Hendrix, B. G.-Toth, Introduction to Nonlinear and Global Optimization, Springer Verlag, Heidelberg, 2010. 4. J.E. Dennis, Jr and R.B. Schnabel, Numerical Methods for Unconstrained Optimization and Nonlinear Equations, SIAM, 1996. 5. A.R. Butt, Applied Linear Algebra and Optimization Using MATLAB, Mercury Learning and Information, 2013. 6. J. Nocedal and S.J. Wright, Numerical Optimization, Second Edition. Springer Series in Operations Research, Springer Verlag, Heidelberg, 2006.
Course in English:	Yes
Quality Monitoring Method:	Course quality and performance monitoring in accordance with the quality management system of the University of Zagreb. Self-evaluation of lecturers and student poll.