

## Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
IND375	Mathematical Modelling with Applications	6	3	0	0	3	4

Prerequisites	IND371
Admission Requirements	IND371

Language of Instruction	French
Course Type	Elective
Course Level	Bachelor Degree
Objective	<p>This course introduces several different types of mathematical models, which can be used to formulate real-life problems, and the softwares GAMS and MATLAB, which can be used to solve different types of problems including linear, non-linear, integer, etc. The aim is to introduce the logic of modeling, which can further be useful for academic studies and in industry. Hence, the objectives of the course are determined as follows:</p> <ul style="list-style-type: none"> <li>• Introduce how to build mathematical models of the real-life problems.</li> <li>• Enable students to use the softwares GAMS and MATLAB for programming and optimization.</li> <li>• Enable students to analyze and interpret the results of the optimization.</li> </ul>
Content	<p>Introduction to GAMS and solution of a simple transportation problem through GAMS</p> <p>Modeling of linear programming problems (Bazaraa, Jarvis &amp; Sherli, Chapter 1, Bertsimas &amp; Tsitsiklis, Chapter 1) and solving linear programming problems through GAMS</p> <p>Sensitivity analysis in linear optimization and analysis of the results of GAMS (Bazaraa, Jarvis &amp; Sherli, Chapter 6)</p> <p>Modeling of integer and mixed integer programming problems (Wolsey, Chapter 1) and solving these problems through GAMS</p> <p>Introduction to MATLAB and the optimization toolbox</p> <p>Introduction to quadratic programming (Fletcher, Chapter 2) and solving these problems through MATLAB, Markowitz Portfolio Model</p> <p>Introduction to unconstrained non-linear optimization (Fletcher, Chapter 2) and solving these problems through MATLAB</p> <p>Karush-Kuhn-Tucker optimality conditions, Lagrange multipliers, and applications for quadratic programming (Fletcher, Chapter 9)</p> <p>Modeling of stochastic programming problems (Birge &amp; Louveaux, Chapter 1) and solving these problems through GAMS</p>
References	<p>Bazaraa, M.S., Jarvis, J.J., Sherli, H.D., "Linear Programming and Network Flows", 4. Edition, Wiley, New Jersey, 2010</p> <p>Bertsimas, D., Tsitsiklis, J.N., "Introduction to Linear Optimization", Athena Scientific Series in Optimization and Neural Computation, Massachusetts, 1997</p> <p>Wolsey, L.A., "Integer Programming", Wiley, New Jersey, 1998</p> <p>Fletcher, R., "Practical Methods of Optimization", 2. Edition, Wiley, Chichester, 2000</p> <p>Birge, J.R., Louveaux, F., "Introduction to Stochastic Programming", Springer, New York, 1997</p> <p>Williams, H.P., "Model Building in Mathematical Programming", 6. Edition, Wiley, Chichester, 2013</p> <p>GAMS Manual, downloadable from <a href="http://www.gams.com/">http://www.gams.com/</a></p>

## Theory Topics

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