

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
IND375	Applied Mathematical Modeling	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"> • Introduce how to build mathematical models of the real-life problems. • Enable students to use the softwares GAMS and MATLAB for programming and optimization. • Enable students to analyze and interpret the results of the optimization.
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Content	<p>Introduction to GAMS and solution of a simple transportation problem through GAMS</p> <p>Modeling of linear programming problems (Bazaraa, Jarvis & Sherali, Chapter 1, Bertsimas & 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 & Sherali, 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 & Louveaux, Chapter 1) and solving these problems through GAMS</p>
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References	<p>Bazaraa, M.S., Jarvis, J.J., Sherali, 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 http://www.gams.com/</p>
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Theory Topics

Week	Weekly Contents
1	Introduction to GAMS and solution of a simple transportation problem through GAMS
2	Modeling of linear programming problems (Bazaraa, Jarvis & Sherali, Chapter 1, Bertsimas & Tsitsiklis, Chapter 1) and solving linear programming problems through GAMS
3	Modeling of linear programming problems (Williams, Part 2) and solving linear programming problems through GAMS
4	Sensitivity analysis in linear optimization and analysis of the results of GAMS (Bazaraa, Jarvis & Sherali, Chapter 6)
5	Modeling of integer and mixed integer programming problems (Wolsey, Chapter 1) and solving these problems through GAMS
6	Modeling of integer and mixed integer programming problems (Williams, Part 2) and solving these problems through GAMS
7	Introduction to MATLAB and the optimization toolbox
8	Midterm
9	Introduction to quadratic programming (Fletcher, Chapter 2) and solving these problems through MATLAB, Markowitz Portfolio Model
10	Introduction to unconstrained non-linear optimization (Fletcher, Chapter 2) and solving these problems through MATLAB
11	Introduction to unconstrained non-linear optimization (Fletcher, Chapter 2) and solving these problems through MATLAB
12	Karush-Kuhn-Tucker optimality conditions, Lagrange multipliers, and applications for quadratic programming (Fletcher, Chapter 9)
13	Modeling of stochastic programming problems (Birge & Louveaux, Chapter 1) and solving these problems through GAMS
14	Modeling of stochastic programming problems (Birge & Louveaux, Chapter 1) and solving these problems through GAMS