Faculty of Mechanical Engineering / /

Course:				
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
10504	Optional	1	8	4+0+0

Programs	
Prerequisites	No conditions
Aims	Upgrade and expansion of acquired knowledge during basic and master academic studies in the field of modeling, optimization and forecasting for needs and applications in industrial engineering, as well as development of creative abilities and mastery of practical skills needed to solve real problems of industrial engineering.
Learning outcomes	After passing the exam, the student will be able to: 1. Knows what mathematical modeling is and the division of mathematical models. 2. Knows deterministic stochastic models. 3. Knows what goals can be achieved using mathematical modeling. 4. Knows the application of software tools and advanced analysis techniques and numerical analysis methods 5. Knows the algorithmic concept of the finite element method and the interpretation of finite elements. 6. Knows what line, surface and volume elements are. 7. Knows the analysis of engineering problems using the finite element method and simulation. 8. Knows optimization and finding the minimum and maximum values of the objective function depending on the set constraints.
Lecturer / Teaching assistant	Prof. dr Mileta Janjić
Methodology	Lectures, exercises.
Plan and program of work	
Preparing week	Preparation and registration of the semester
I week lectures	Modeling. Mathematical modeling.
I week exercises	Creation of examples from mathematical modeling.
II week lectures	Division of mathematical models. Deterministic Models.
II week exercises	Creation of examples from deterministic models.
III week lectures	Stochastic models.
III week exercises	Creation of examples from stochastic models.
IV week lectures	Goals that can be achieved using mathematical modeling.
IV week exercises	Examples of mathematical modeling goals.
V week lectures	Modeling as part of modern design methods.
V week exercises	Examples of the application of modeling in the design of production processes.
VI week lectures	Application of software tools and advanced analysis techniques.
VI week exercises	Using modeling software tools.
VII week lectures	Algorithmic concept of the finite element method (FEM).
VII week exercises	Examples of application of MKE.
VIII week lectures	Numerical methods of analysis.
VIII week exercises	Creation of tasks from numerical methods.
IX week lectures	Interpretation of finite elements.
IX week exercises	Examples of application of MKE results.
X week lectures	Line elements. Surface elements. Volume elements.
X week exercises	Examples of the influence of the type of finite elements.
XI week lectures	Analysis of engineering problems using the finite element method.
XI week exercises	Examples of FEM application in solving engineering problems.
XII week lectures	Simulation.
XII week exercises	Examples of simulations

XIII week lectures	Optimization.
XIII week exercises	Examples of optimization.
XIV week lectures	Finding the minimum and maximum values of the objective function depending on the set constraints.
XIV week exercises	Creating an example of finding extreme values of the objective function.
XV week lectures	Overview of optimization methods.
XV week exercises	Application of optimization methods
Student workload	

Per week	**Per semester**
8 credits x 40/30=10 hours and 40 minuts 4 sat(a) theoretical classes 0 sat(a) practical classes 0 excercises **6 hour(s) i 40 minuts** of independent work, including consultations	Classes and final exam: **10 hour(s) i 40 minuts x 16 =170 hour(s) i 40 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **10 hour(s) i 40 minuts x 2 =21 hour(s) i 20 minuts** Total workload for the subject: **8 x 30=240 hour(s)** Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) **48 hour(s) i 0 minuts** Workload structure: **170 hour(s) i 40 minuts (cources), 21 hour(s) i 20 minuts (preparation), 48 hour(s) i 0 minuts (additional work)**
Student obligations	Students are required to attend lectures, exercises, do project work and the final exam.
Consultations	On the day of classes, after classes.
Literature	• P. Hartley, I. Pillinger, C. Sturgess, Numerical Modelling of Material Deformation Processes, Springer-Verlag, London, 1992. • M. A. Crisfield, Non-linear Finite Element Analysis of Solids and Structures, John Wiley & Sons, West Sussex, England, 1991. • F. S. Hillier, Lieberman, G. J.: Introduction to operations research (seventh edition), McGraw-Hill, New York, 2000. • J. Petrić, Operaciona istraživanja (knjiga 1 i 2), Savremena administracija, Beograd, 1990.
Examination methods	• Project work - 20 points; • Final exam - 80 points. • A passing grade is obtained if at least 50 points are accumulated cumulatively.
Special remarks	
Comment	

Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points