Faculty of Metalurgy and Technology / / APPLICATION OF NUMERICAL METHODS IN ENGINEERING

Course:	APPLICATION OF NUMERICAL METHODS IN ENGINEERING			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
12242	Mandatory	3	6	2+2+0
Programs				
Prerequisites	There is no conditioning to other subjects.			
Aims	Acquaintance with numerical methods for solving tasks in a wide range of areas of process technology engineering. Mastering theprocessing and analysis of data on processes and technologies using modern technical software packages (eg Statgraphics). Getting toknow the procedure for preparing and solving tasks for functional dependencies of selected processes and systems from the field ofprocess technology engineering using software packages (Matlab-Simulink, FEM).			
Learning outcomes	After passing this exam, the student will be able to: 1. Recognize and explain engineering tasks for which numerical solution methods should be used. 2. Understand the possibility of application and choose an adequate method for the significance and planned accuracy of solutions toengineering tasks. 3. Systematize data for measured quantities for a sufficient number of practical problems, understand the task for their processing andanalysis using modern software packages for processing, extrapolation and forecasting changes in process quantities. 4. Apply the Matlab software package for solving mathematical functions in technical problems. 5. Recognize the properties of the system essential for creating a mathematical model and apply the Matlab-Simulink software package forthe simulation of dynamic systems. 6. Compile a simulation scheme of the mathematical functions of the system suitable for solving problems using the FEM program package. 7. Apply the FEM software package for the complete solution of a complex task in the field of engineering.			
Lecturer / Teaching assistant	Teachers: Assoc. Dr. Nebojsa Tadić; Asst. Dr. Bozidar Popović.			
Methodology	Lectures, exercises, consultations, homework, midterm exams, final exam.			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Errors (types, significance).			
I week exercises	Solving tasks with error calculations.			
II week lectures	Interpolation (forms of interpolation polynomial, error evaluation, spline interpolation).			
II week exercises	Solving interpolation problems.			
III week lectures	Solving systems of linear equations (norm of vectors and matrices, conditioning of systems of linear equations, methods of solving).			
III week exercises	Examples of tasks for solving systems of linear equations.			
IV week lectures	Solving nonlinear equations (solution method, systems of nonlinear equations).			
IV week exercises	Examples of tasks for solving systems of nonlinear equations.			
V week lectures	Least squares problem (method for linear and non-linear least squares problems).			
V week exercises	Examples of problems for least squares problems.			
VI week lectures	Midterm exam. Numerical integration.			
VI week exercises	Examples of problems for numerical integration.			
VII week lectures	Numerical solution of ordinary differential equations.			
VII week exercises	Examples for the numerical solution of ordinary differential equations.			
VIII week lectures	Makeup midterm exam. Numerical solution of partial differential equations.			
VIII week exercises	Examples for the numerical solution of partial differential equations.			
IX week lectures	TASKS FOR NUMERICAL SOLUTION, MODELING AND SIMULATION IN ENGINEERING.Statistical data processing, interpolation and forecasting - Example solutions using the Statgraphics program. Division of the first task for students independent work (the task is adapted to the module of the study program).			
IX week exercises	TASKS FOR NUMERICAL SOLUTION, MODELING AND SIMULATION IN ENGINEERING.Statistical data processing, interpolation and forecasting - Example solutions using the Statgraphics program. Division			

	of the first task for students independent work (the task is adapted to the module of the study program).
X week lectures	TASKS FOR NUMERICAL SOLUTION, MODELING AND SIMULATION IN ENGINEERING.Modeling, simulation and system analysis - Solving tasks for fundamental functions, macro processes and dynamic systems inengineering using the Matlab-Simulink software package. Division of the second task for students independent work (the task is adaptedto the module of the study program).
X week exercises	TASKS FOR NUMERICAL SOLUTION, MODELING AND SIMULATION IN ENGINEERING.Modeling, simulation and system analysis - Solving tasks for fundamental functions, macro processes and dynamic systems inengineering using the Matlab-Simulink software package. Division of the second task for students independent work (the task is adaptedto the module of the study program).
XI week lectures	Modeling, simulation and system analysis. Continuation of work on solving the second independent task of students using the Matlab-Simulink software package.
XI week exercises	Modeling, simulation and system analysis. Continuation of work on solving the second independent task of students using the Matlab-Simulink software package.
XII week lectures	TASKS FOR NUMERICAL SOLUTION, MODELING AND SIMULATION IN ENGINEERING.Solving tasks using the Finite Element Method. Application of the FEM software package for selected examples in engineering. Division of the third task for students independent work (the task is adapted to the module of the study program).
XII week exercises	TASKS FOR NUMERICAL SOLUTION, MODELING AND SIMULATION IN ENGINEERING.Solving tasks using the Finite Element Method. Application of the FEM software package for selected examples in engineering. Division of the third task for students independent work (the task is adapted to the module of the study program).
XIII week lectures	Solving tasks using the Finite Element Method. Continuation of work on solving the third independent task of students.
XIII week exercises	Solving tasks using the Finite Element Method. Continuation of work on solving the third independent task of students.
XIV week lectures	Solving tasks using the Finite Element Method. Continuation of work on solving the third independent task of students.
XIV week exercises	Solving tasks using the Finite Element Method. Continuation of work on solving the third independent task of students.
XV week lectures	Submission and presentation of student works.
XV week exercises	Submission and presentation of student works.
Student workload	Weekly: 6 credits x 40/30 = 8 hours. Total load for the semester: 6 credits x 30 = 180 hours.

Per week	**Per semester**
6 credits x 40/30=8 hours and 0 minuts 2 sat(a) theoretical classes 0 sat(a) practical classes 2 excercises **4 hour(s) i 0 minuts** of independent work, including consultations	Classes and final exam: **8 hour(s) i 0 minuts x 16 =128 hour(s) i 0 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **8 hour(s) i 0 minuts x 2 =16 hour(s) i 0 minuts** Total workload for the subject: **6 x 30=180 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) **36 hour(s) i 0 minuts** Workload structure: **128 hour(s) i 0 minuts (cources), 16 hour(s) i 0 minuts (preparation), 36 hour(s) i 0 minuts (additional work)**
Student obligations	The student is obliged to attend lectures and exercises, pass the midterm exam and do the tasks for numerical solving.
Consultations	Consultations are on days when there are lectures and exercises, and on other days by agreement with the students.
Literature	R. Scitovski, Numerical mathematics, second edition, Osijek 2004. J. P. Milišić, Introduction to numerical mathematics for engineers, Zagreb, 2013. G. V. Milovanović and others, Numerical mathematics, Collection of solved problems, Niš/Kragujevac, 2002. L J. Stanković and others, Matlab, Podgorica, 2008. Statgraphics Centurion, Version 17 Enhancements, 2015, Statpoint Technologies. L. Lazić, Numerical methods in heat treatment, Sisak, 2007. J. Fluhrer, DEFORMTM 2D - Users Manual, Scientific Forming Technologies Corporation, Ohio.
Examination methods	One midterm exam 20 points; Three independent student works (first - 7,

			second - 10, third - 13) total 30 points; Final exam 50 points. A passing grade is obtained if 50 points are accumulated cumulatively. The final exam is mandatory.			
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