

Study program: Information Technology			
Course title: COMPUTER MODELLING OF PHYSICS PHENOMENA			
Teacher(s): Milentije D. Lukovic			
Course status: elective			
Number of ECTS credits: 6			
Prerequisite courses: none			
Course objectives			
An introduction the methods for forming and solving mathematical models of physical phenomena. Students will become more familiar with methods of computer simulations from applied physics through the use of several software packages (<i>Mathematica</i> , <i>Origin</i> , ...). Examples of applications and simulations used in modeling laboratory experiments, data processing, simulation experiments. Training students through examples and procedures, which motivate them to improve their further training.			
Learning outcomes			
The student is expected to know different methods for applying computer simulations in physics, as well as software packages that can be used for this purpose. Training students to write simulation programs related to various physical phenomena and processes, as well as the application of a suitable model for their graphic representation and visualization. Student's ability to use software packages for experiment design and modeling, processing and graphical presentation of measurement results.			
Content of the course			
<i>Theoretical teaching</i>			
Overview of <i>Mathematica</i> software. Numerical methods for solving mathematical problems in the program packages <i>Mathematica</i> , <i>Origin</i> , ... Mathematical representation of physical problems and examples of numerical calculations. Basic terms from the software package required for effective graphical representation and visualization of physical processes. Simulations of physical phenomena in kinematics, dynamics, gravitational field, oscillatory and wave motion, wave optics, atomic physics, electric and magnetic fields. Random number generators, basic concepts of Monte Carlo simulation in <i>Mathematica</i> . Graphic presentation of results, their processing and analysis.			
<i>Practical teaching</i>			
Analysis of simpler simulations using the necessary mathematical apparatus for a detailed explanation of certain physical phenomena. Exercises from the <i>Mathematica</i> and <i>Origin</i> software packages related to the modeling of physical phenomena. Seminar work on the subject covered by the lectures (implies independent development of simple simulation programs).			
Literature			
[1] M. Luković, Zbirka rešenih zadataka iz Fizike korišćenjem aplikacija u programskom paketu Mathematica, Fakultet tehničkih nauka u Čačku, Univerzitet u Kragujevcu, Čačak, 2023.			
[2] Cliff Hastings, Kelvin Mischo, Michael Morrison, Hands-on Start to Wolfram Mathematica and Programming with the Wolfram Language, 3rd ed., Wolfram Media, 2020.			
[3] Andrey Grozin, Introduction to Mathematica for Physicists (Graduate Texts in Physics), 2014th Edition, Springer, 2014.			
[4] P. S. Stanimirović, G. V. Milovanović, Programski paket Mathematica i primene, Elektronski fakultet u Nišu, Edicija monografije, Niš, 2002.			
[5] S. Wolfram, The Mathematica Book, 5th ed., Wolfram Media, 2003.			
[6] M. Gocić, Instructions for the program package MATHEMATICA, Faculty of Civil Engineering and Architecture, Niš, 2015.			
Number of active teaching classes: 4		Theoretical teaching: 2	Practical teaching: 2
Teaching methods			
Lectures, calculation exercises, computer exercises.			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations	Points	Final exam	Points
Activities during teaching process	5	Final exam (written):	20
Practical teaching	10	Final exam (oral):	30
Colloquium	15		
Practical teaching	20		