Study program: Information technology

Type and level of studies: Undergraduate Academic Studies

Course unit: Computer Modelling of Physics Phenomena

Teacher in charge: Milentije D. Luković

Language of instruction: English

ECTS: 6

Prerequisites: -

Semester: Summer

Course unit objective:

An introduction to 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 (*Mathematica*, *Origin*, ...). 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 of Course unit:

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.

Course unit contents:

Theoretical classes

Overview of *Mathematica* software. Numerical methods for solving mathematical problems in the program packages *Mathematica*, *Origin*, etc. 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 *Mathematica*. Graphic presentation of results, their processing and analysis.

Practical classes

Analysis of simpler simulations using the necessary mathematical apparatus for a detailed explanation of certain physical phenomena. Exercises from the *Mathematica* and *Origin* 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 hours: 4	**Lectures: 2**	**Practice: 2**

Teaching methods:

Lectures, calculation exercises, computer exercises

Evaluation (maximum number of points 100)

Exam prerequisites:	No. of points:	**Final exam:**	No. of points:
Activities during teaching process	5	Final exam (written):	20
Practical teaching	10	Final exam (oral):	30
Colloquium	15		
Practical teaching	20		