

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Numerične metode v fiziki
Course title:	Numerical Methods in Physics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika, 1. stopnja		2	4
Physics, 1st cycle			

Vrsta predmeta / Course type

Obvezni / obligatory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
30		15	30		165	8

Nosilec predmeta / Lecturer:

Zidanšek Aleksander

Jeziki /

Predavanja / Lectures:

slovenski / Slovenian

Languages:

Vaje / Tutorial:

slovenski / Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Priporočeno je predznanje iz osnov računalništva, analize in algebre ter matematične fizike.

Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno. Opravljeno laboratorijsko delo in opravljen projekt sta pogoj za pristop k ustnemu izpitu.

Prerequisites:

Recommended is preknowledge from computing, calculus, algebra and mathematical physics.

Each of the listed obligations in the assessment methods must be completed with a positive grade. Completed laboratory work and project are a prerequisite for taking the oral exam.

Vsebina:

Content (Syllabus outline):

Programiranje, delo s tabelami. Numerične metode in fizikalno ozadje: sistemi linearnih enačb, nelinearne enačbe, interpolacija, odvajanje, integriranje, navadne diferencialne enačbe, parcialne diferencialne enačbe. Metode Monte Carlo, metoda molekularne dinamike, simulacija delovanja možganov in nevronske mreže. Uporaba simbolnega paketa pri reševanju izbranih fizikalnih problemov.

Programming, work with arrays. Numerical methods and physical background: Systems of linear equations, nonlinear equations, interpolation, derivation and integration, ordinary differential equations, partial differential equations. Monte Carlo methods, molecular dynamics methods, simulation of the brain processes and neural networks. Using of symbolic packet by solving some physical problems.

Temeljni literatura in viri / Readings:

- W.H. Press in dr.: Numerical Recipes, The Art of Scientific Computing, Cambridge University Press, 2007
- F. J. Vesely: Computational Physics, An Introduction, Springer, 2012.
- Z. Bohte: Numerične metode. Ljubljana: DMFA, 1991,

Cilji in kompetence:

Študentje pridobijo teoretična in praktična znanja iz uporabe računalnika pri reševanju fizikalnih problemov.

Objectives and competences:

Students acquire theoretical and practical knowledge about the use of computer to solve physical problems.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku predmeta študent:

- pozna, razume in uporabi numerične metode za reševanje fizikalnih problemov:

- odvajanje in integriranje,
- iskanje ničel enačb,
- sistemi linearnih enačb,
- diferencialne enačbe,
- uporaba naključnih števil,

- zna opisati enostavne fizikalne sisteme numerično,

- je sposoben programirati in izračunati numerične modele fizikalnih sistemov.

Prenesljive/ključne spretnosti in drugi atributi:

Študent je sposoben uporabe numeričnih metod tudi na drugih področjih.

Prav tako se zaveda pomena numeričnega reševanja modelov ter zmore programirati numerične modele tudi za kompleksne sisteme.

Intended learning outcomes:

Knowledge and understanding:

Upon completion of the course, the students:

- know, understand and apply numerical methods for solving physical problems:

- Differentiation and integration.
- Roots of equations.
- Systems of linear equations.
- Differential equations.
- Use of random numbers,

- is able to describe simple physical systems numerically,

- is able to program and calculate numerical models of physical systems.

Transferable/Key Skills and other attributes:

The students are able to apply numerical methods also in other fields.

The students are aware of the importance of numerical solving of models and able to program numerical models also for complex systems.

Metode poučevanja in učenja:

Razlaga, razgovor, študij primerov, problemsko učenje, laboratorijsko delo z računalniki.

Learning and teaching methods:

Lecture, discussion, case studies, problem based learning, laboratory work with computers.

Načini ocenjevanja:

laboratorijsko delo
projekt
ustni izpit

Delež (v %) /

Weight (in %) **Assessment:**

35

35

30

laboratory work
project
oral exam

Reference nosilca / Lecturer's references:

1. ZID, Maha, PAL, Kaushik, HARKAI, Saša, ABINA, Andreja, KRALJ, Samo, ZIDANŠEK, Aleksander. Qualitatively and quantitatively different configurations of nematic–nanoparticle mixtures. *Nanomaterials*. [Online ed.]. 2024, vol. 14, issue 5, str. 1-16. ISSN 2079-4991. DOI: [10.3390/nano14050436](https://doi.org/10.3390/nano14050436). [COBISS.SI-ID [187069955](https://cobiss.si/id/187069955)]
2. ABINA, Andreja, PUC, Uroš, JAZBINŠEK, Mojca, ZIDANŠEK, Aleksander. Analytical gas sensing in the terahertz spectral range. *Micromachines*. 2023, vol. 14, str. 1-38, ilustr. ISSN 2072-666X. <https://www.mdpi.com/2072-666X/14/11/1987>, DOI: doi.org/10.3390/mi14111987. [COBISS.SI-ID [170582019](https://cobiss.si/id/170582019)]
3. ZIDANŠEK, Aleksander, HÖLBL, Arbresha, RANJKESH SIAHKAL, Amid, CORDOYIANNIS, George, KUTNJAK, Zdravko, KRALJ, Samo. Impact of random-field-type disorder on nematic liquid crystalline structures. *The European physical journal. E., Soft matter*. 2022, vol. 45, no. 7, str. 63-1-63-12, ilustr. ISSN 1292-895X. DOI: [10.1140/epje/s10189-022-00217-y](https://doi.org/10.1140/epje/s10189-022-00217-y). [COBISS.SI-ID [116649731](https://cobiss.si/id/116649731)]
4. VASUDEVAN, Aswathy, SHVALYA, Vasyl, KOŠIČEK, Martin, ZAVAŠNIK, Janez, JUROV, Andrea, SANTHOSH, Neelakandan Marath, ZIDANŠEK, Aleksander, CVELBAR, Uroš. From faceted nanoparticles to nanostructured Thin Film by Plasma-Jet Redox Reaction of Ionic Gold. *Journal of alloys and compounds*. [Print ed.]. Dec. 2022, vol. 928, [article no.] 167155, str. 1-11, ilustr. ISSN 0925-8388. DOI: [10.1016/j.jallcom.2022.167155](https://doi.org/10.1016/j.jallcom.2022.167155). [COBISS.SI-ID [121112067](https://cobiss.si/id/121112067)]