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		**2**	**4**
Physics			

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 / Languages:		
	Predavanja / Lectures:	slovenski / Slovenian
	Vaje / Tutorial:	slovenski / Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Ni zahtev. Priporočeno znanje iz osnov računalništva, analize in algebre ter matematične fizike.	None. Recommended knowledge from computing, calculus, algebra and mathematical physics.

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:	Delež (v %) / Weight (in %)	**Assessment:**
dnevnik lab. vaj	**35**	logbook of laboratory work
projektna naloga	**35**	project assignment
ustni izpit	**30**	oral exam

Za uspešno zaključeno učno enoto mora biti vsak del posebej pozitiven. Pozitivno ocenjen dnevnik laboratorijskih vaj in opravljena projektna naloga sta pogoj za pristop k izpitu.		For a successfully completed course, each part of the assessment has to be positive. A positive evaluation of the laboratory workbook and the completed project assignment are required for admission to the exam.

Reference nosilca / Lecturer's references:

- GUDIMALLA, Apparao, THOMAS, Sabu, ZIDANŠEK, Aleksander. Phase behaviour of n-CB liquid crystals confined to controlled pore glasses. Journal of molecular structure. [Print ed.]. 2021, vol. 1235, str. 130217-1-130217-12. ISSN 0022-2860. DOI: 10.1016/j.molstruc.2021.130217. [COBISS.SI-ID 66828547]
- JOZIČ, Primož, ZIDANŠEK, Aleksander, REPNIK, Robert. Fuel conservation for launch vehicles: Falcon Heavy case study. Energies. 2020, vol. 13, no. 3, str. 1-10. ISSN 1996-1073. DOI: 10.3390/en13030660. [COBISS.SI-ID 25125640]
- PUC, Uroš, ABINA, Andreja, JEGLIČ, Anton, ZIDANŠEK, Aleksander, KAŠALYNAS, Irmantas, VENCKEVIČIUS, Rimvydas, VALUŠIS, Gintaras. Spectroscopic analysis of melatonin in the terahertz frequency range. Sensors. 2018, vol. 18, no. 12, str. 4098-1-4098-12. ISSN 1424-8220. DOI: 10.3390/s18124098. [COBISS.SI-ID 31962407]
- JAZBINŠEK, Mojca, PUC, Uroš, ABINA, Andreja, ZIDANŠEK, Aleksander. Organic crystals for THz photonics. Applied sciences. 2019, vol. 9, no. 5, str. 882-1-882-45. ISSN 2076-3417. DOI: 10.3390/app9050882. [COBISS.SI-ID 32214055]
- VASUDEVAN, Aswathy, SHVALYA, Vasyl, ZIDANŠEK, Aleksander, CVELBAR, Uroš. Tailoring electrical conductivity of two dimensional nanomaterials using plasma for edge electronics : a mini review. Frontiers of Chemical Science and Engineering. 2019, vol. 13, no. 3, str. 427-443. ISSN 2095-0179. DOI: 10.1007/s11705-019-1805-4. [COBISS.SI-ID 32306471]