Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Reševanje problemov v fiziki**
Course title:	**Problem Solving in Physics**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		1. ali 2.	**1., 2. ali 4.**
PHYSICS		1. or 2.	**1., 2. or 4.**

Vrsta predmeta / Course type: Izbirni za modul Izobraževalna fizika

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
10	**5**				**165**	**6**

Nosilec predmeta / Lecturer: **Marko Gosak**

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Ni posebnih zahtev.	None.

Vsebina:	**Content (Syllabus outline):**
Predavanja: - osnove psihologije mišljenja in reševanja problemov - reševanje problemov v fiziki - strategije reševanja problemov v fiziki - razvoj tehnik in spretnosti za reševanje problemov - zvrsti zastavljanja problemov - evaluacija problemov v fiziki - modeliranje v fiziki kot način reševanja problemov	Lectures: - Psychological foundations of thinking and problem solving - Problem solving in physics - Strategies for solving physical problems - Development of problem solving skills - Spectrum in posing physics problems - Evaluation of physics problems - Modelling in physics as example of problem solving

Seminar: - priprava, prezentacija in diskusija fizikalnih problemov - evaluacija fizikalnih problemov	Seminar: - Preparation, presentation and discussion of physics problems - Evaluation of physics problems

Temeljni literatura in viri / Readings:

1. J. R. Anderson, Cognitive Psychology and Its Implications, Worth Publishers, 2005
2. R. E. Mayer, Thinking, Problem Solving, Cognition, Freeman and Co., New York, 1992
3. J. D. Bransford, B. S. Stein, The Ideal Problem Solver, Freeman and Co., New York, 1984
4. D. Scarl, How to Solve Problems: For Success in Freshman Physics, Engineering , and Beyond, Dosoris Prss, Glen Cove, New York 1993
5. Joseph Molitoris: The Physics Problem Solver (Problem Solvers Solution Guides), ISBN-10: 9780878915071

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je pridobiti si znanje za razumevanje mišljenjskih procesov, ki potekajo ob reševanju fizikalnih problemov. Cilj je natrenirati metode in strategije reševanja problemov. Študenti razvijejo sposobnosti za produkcijo in ocenjevanje novih fizikalnih problemov.	The goal of the course is to provide for an understanding of the cognitive process which take place in solving (physics) problems. Different methods and strategies of problem solving are trained. The students develop skills to create and evaluate physics problems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti usvojijo in poglobijo znanje o trenutnih znanstvenih raziskavah na področju mišljenja in reševanja problemov s stališča kognitivne psihologije. Usvojijo različne strategije za reševanje problemov in razumejo različne lastnosti in namene fizikalnih problemov. Prenesljive/ključne spretnosti in drugi atributi: Zmožnost kritičnega presojanja fizikalnih problemov. Zmožnost ustvarjanja novih fizikalnih problemov za različne starostne stopnje.	Knowledge and understanding: The students gain and deepen their knowledge about the current scientific status how thinking and problem solving is explained by cognitive psychology. They know different strategies for problem solving and understand distinctive features of physical problems. Transferable/Key Skills and other attributes: Ability for a critical judgment of physical problems. Ability to create physical problems, in particular with regard to the age of students.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, skupinsko delo, individualno delo	Lectures, seminars, group work, individual work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Projekt priprave in evaluacije fizikalnih problemov	**50 %**	Project of preparation and evaluation of physics problems
Ustni zagovor	**50 %**	Oral exam

Reference nosilca / Lecturer's references:

1. GOSAK, Marko, STOŽER, Andraž, MARKOVIČ, Rene, DOLENŠEK, Jurij, MARHL, Marko, RUPNIK, Marjan, PERC, Matjaž. The relationship between node degree and dissipation rate in networks of diffusively coupled oscillators and its significance for pancreatic beta cells. *Chaos*, ISSN 1054-1500, July 2015, vol. 25, iss. 7, 073115-1-073115-8, doi: 10.1063/1.4926673. [COBISS.SI-ID 512523576],

2. GOSAK, Marko, DOLENŠEK, Jurij, MARKOVIČ, Rene, RUPNIK, Marjan, MARHL, Marko, STOŽER, Andraž. Multilayer network representation of membrane potential and cytosolic calcium concentration dynamics in beta cells. *Chaos, solitons and fractals*. [Print ed.], 2015, vol. 80, str. 76-82, ilustr. http://www.sciencedirect.com/science/article/pii/S0960077915001794, doi: 10.1016/j.chaos.2015.06.009. [COBISS.SI-ID 512513080],

3. ŠIMONKA, Vito, FRAS, Maja, GOSAK, Marko. Stochastic simulation of the circadian rhythmicity in the SCN neuronal network. *Physica. A, Statistical mechanics and its applications*, ISSN 0378-4371. [Print ed.], 2015, vol. 424, str. 1-10, ilustr., doi: 10.1016/j.physa.2014.12.034. [COBISS.SI-ID21059592],

4. GOSAK, Marko, MARKOVIČ, Rene, FAJMUT, Aleš, MARHL, Marko, HAWLINA, Marko, ANDJELIĆ, Sofija. The analysis of intracellular and intercellular calcium signaling in human anterior lens capsule epithelial cells with regard to different types and stages of the cataract. *PloS one*, ISSN 1932-6203, 2015, vol. 10, iss. 12. http://dx.doi.org/10.1371/journal.pone.0143781, doi: 10.1371/journal.pone.0143781. [COBISS.SI-ID 2645676],

5. FRAS, Maja, GOSAK, Marko. Spatiotemporal patterns provoked by environmental variability in a predator-prey model. *Biosystems*, ISSN 0303-2647. [Print ed.], 2013, vol. 114, iss. 3, str. 172-177, doi: 10.1016/j.biosystems.2013.09.004. [COBISS.SI-ID 20069896],

6. MARKOVIČ, Rene, GOSAK, Marko, MARHL, Marko. How optimal synchronization of oscillators depends on the network structure and the individual dynamical properties of the oscillators. V: *IC-MSQUARE 2012 : International Conference on Mathematical Modelling in Physical Sciences, 3-7 September 2012, Budapest, Hungary*, International Conference on Mathematical Modelling in Physical Sciences, 3-7 September 2012, Budapest, Hungary, (Journal of Physics, ISSN 1742-6596, Conference series, Vol. 410). [S. l.: s. n.], 2013, str. 012044-1-012044-4. http://iopscience.iop.org/1742-6596/410/1/012044/pdf/1742-6596_410_1_012044.pdf, doi: 10.1088/1742-6596/410/1/012044. [COBISS.SI-ID 19739400],

7. GOSAK, Marko, MARKOVIČ, Rene, MARHL, Marko. The role of neural architecture and the speed of signal propagation in the process of synchronization of bursting neurons. *Physica. A,*

Statistical mechanics and its applications, ISSN 0378-4371. [Print ed.], 2012, vol. 391, no. 8, str. 2764-2770, ilustr., doi: 10.1016/j.physa.2011.12.027. [COBISS.SI-ID 18948872],