Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Didaktika fizike 2 s praktikumom**
Course title:	**Didactics of physics 2 with practicum**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Enovit magistrski študijski program druge stopnje Predmetni učitelj	/	3, 4	5, 7
Five-year master's degree program Subject Teacher	/		

Vrsta predmeta / Course type	Obvezni / Compulsory
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
60			45		135	8

Nosilec predmeta / Lecturer:	Robert Repnik

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogojev ni.	None.

Priporočljiva znanja: osnovne veščine iz varnega laboratorijskega dela in osnovna znanja iz osnovnih področij fizike ter iz splošne didaktike.	Recommended knowledge are: basic skills of safe laboratory work, basic knowledge of physics and of general didactics.

Vsebina:	**Content (Syllabus outline):**
Predavanja • Načrt dela, cilji pouka fizike, kompetence učiteljev fizike v srednji šoli; • didaktični elementi izvajanja pouka fizike v srednjih šolah, teorije poučevanja in pouk fizike v srednjih šolah; • učni načrti in učna gradiva za pouk fizike v srednjih šolah • učne metode in oblike pouka fizike v srednjih šolah • eksperimentalni in problemski pouk fizike v srednjih šolah • priprava na pouk fizike v srednjih šolah in evalvacija; • preverjanje in ocenjevanje znanja ter vrednotenje eksperimentalnega dela v srednjih šolah. Avtentične naloge; • učni prostori za pouk fizike v srednjih šolah; • učila in učni pripomočki za pouk fizike v srednjih šolah; • izobraževalna in IKT tehnologija pri pouku fizike v srednjih šolah. Konceptualni pouk fizike. • sodobni trendi in projekti poučevanja fizike v srednjih šolah; • splošna in poklicna matura iz fizike. • Elementarna fizika. • Fizikalna tekmovanja. • Sodobne vsebine fizike in kurikular. • Priprava e-gradiv za pouk fizike. LV: Izvedba kvalitativnih in kvantitativnih meritev: - izvedba demonstracijskega, skupinskega in samostojnega domačega (kuhinjska fizika)	Lectures • Learning and working plan, goals of physics education, competences of physics teacher in secondary education; • didactic elements of physics education in secondary schools, theories of teaching and physics education in secondary education; • physics curriculum and educational resources for secondary physics education; • education methods and forms in secondary physics education; • problem solving and experimental physics teaching in secondary education; • lesson planning on physics secondary education and evaluation; • Assessment and grading of knowledge and evaluation of experimental work in secondary schools. Authentic tasks; • didactic places for teaching physics in secondary schools; • teaching aids and accessories for secondary physics education; • educational and ICT technology in secondary physics education. Conceptual physics education. • contemporary trends and projects of secondary physics education; • final physics exam (matura). • Elementary physic. • Physics competition. • Contemporary contents of physics and curricular design. • Preparing E-materials for class of physics. LW: Implementation of qualitative and quantitative

eksperimentalnega dela na primerih iz fizikalnih področij, predvidenih v učnem načrtu in potrjenih učbenikih za srednjo šolo - nivojsko izvajanje eksperimentalnega dela, diferenciacija in individualizacija pri srednješolskem fizikalnem eksperimentiranju - problemska zasnovanost eksperimentalnega dela, vloga podpornih materialov in aktivnosti pri tem (navodila za delo, navodila za uporabo pripomočkov, učni in delovni listi, razlaga in razgovor...) - vloga priprave na izvedbo vaj, razdelitev dela v skupini - pisno in verbalno poročanje o rezultatih - razvoj različnih taksonomskih globin znanj ob pripravi in izvajanju eksperimentalnega dela - uporaba posameznih elementov fizikalne eksperimentalne opreme, uporaba zbirk in priročne opreme - uporaba računalnika, vmesnikov, senzorjev, druge IKT in multimedijske opreme pri eksperimentalnem delu v srednji šoli Projektna naloga: • Samostojno delo: zasnovati in pripraviti eksperimentalno vajo, izvesti vajo in poročilo o vaji, pripraviti navodila in varnostna opozorila, vajo predstaviti strokovni in laični javnosti ter odgovarjati na vprašanja, uporaba IKT.	measurements: - Implementation of a demonstrational, group and autonomous home- (kitchen physics) experimental work on cases of physical fields provided in the curriculum and approved textbooks for secondary school - Level based implementation of experimental work, individualisation and differentiation in physics experimentation in secondary school - Problem-based experimental work, the role of supporting materials and activities (work instructions, instructions for use of devices, learning- and worksheets, interpretation and discussion...) - The role of the preparations for the execution of exercises, the division of labor work within the group - Written and verbal reporting of results - Development of different taxonomical depths of knowledge in preparation and implementation of experimental work - Use of individual components of physics experimental equipment, the use of experimental sets and handy equipment - Use of computer, interfaces, sensors and other ICT and multimedia equipment in the experimental work in secondary school. Project work: • Autonomous work: to design and prepare a experimental exercise, execute and prepare report, prepare instructions and safety warnings, present exercise to professional and lay public and to answer questions, use of ICT.

Temeljni literatura in viri / Readings:

Osnovno / primary:

- Cohen L., Manion L., Morrison K. Research methods in education, 6th edition. Routledge, Taylor&Francis Group, New York, USA, 2007.
- Gerlič, V. Udir. Problemski pouk fizike v OŠ. Zavod RS zašolstvo, Ljubljana, 2006.
- Gerlič. Sodobna informacijska tehnologija v izobraževanju. DZS, Ljubljana, 2000.
- Veljavni predmetniki, učni načrti, učbeniki, priročniki, delovni zvezki, didaktični kompleti in ostalo didaktično gradivo za pouk fizike v srednjih šolah/syllabuses, learning plans, textbooks, handbooks, didactic materials for teaching in primary schools
- Revije: Fizika v šoli, Presek, Življenje in tehnika. Physics Teacher, Physics Education.
- E-študijska gradiva na spletnih straneh FNM UM

Dodatno / secondary:

- Barica M. Požarnik. Kakršno vprašanje, takšen odgovor. IMPRESUM Zavod RS za šolstvo, Ljubljana 1980
- Franc Strmčnik. Problemski pouk v teoriji in praksi. Didakta, Radovljica 1992
- France Strmčnik. Sodobna šola v luči učne diferenciacije in individualizacije. ZOTKS, Ljubljana 1987
- Blažič, M.,Ivanuš Grmek, M.,Kramar, M., Strmčnik, F. (2003). Didaktika. Visokošolski učbenik. Novo mesto: Visokošolsko središče, Inštitut za raziskovalno in razvojno delo.
- Navodila za izvedbo vaj/ Guidelines for the laboratory work
- Znanstveni in strokovni članki v znanstvenih in strokovnih revijah / Scientific and technical papers in scientific and technical journals
- J. Strnad, Fizika, 1. in 2. del, (DMFA, Ljubljana, 2002)
- Na spletnih straneh Oddelka za fiziko objavljena elektronska gradiva./ teaching material published on websites of Department of Physics
- Didaktična gradiva projekta Razvoj naravoslovnih kompetenc /Didactic materials of the project Development of natural science competences

Cilji in kompetence:

- Študent usvoji specialna fizikalna, didaktična, pedagoška in psihološka znanja potrebna za učinkovito poučevanje fizike v osnovni šoli s fokusom na fizikalno eksperimentalnem delu v srednji šoli.

Objectives and competences:

- Student adopts special physics, didactic, pedagogical and psychological knowledge for effective classroom physics teaching in primary schools with focus on experimental work in secondary (high) schools.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po uspešno zaključeni učni enoti je študent

zmožen:

Intended learning outcomes:

Knowledge and understanding:

On completion of this course student will be able to:

- seznaniti se s teoretičnimi izhodišči poučevanja srednješolske fizike;
- spoznati in razumeti učne načrte in obstoječa učna gradiva za pouk fizike v srednjih šolah;
- obravnavati pomembne didaktične in fizikalne razvojne koncepte srednješolske fizike;
- seznaniti se s srednješolsko zakonodajo oz. jo znati poiskati;
- nadgraditi znanja o možnosti uporabe IKT pri pouku srednješolske fizike
- spoznati in načrtovati različne učne oblike in metode dela pouka fizike v srednjih šolah;
- pridobiti dodatne izkušnje načrtovanja pouka fizike, izdelave učne priprave, izvedbe nastopa pred učenci,
- evalviranja nastopa in ocenjevanja znanja učencev srednjih šol;

- know and understant theoretical platforms of secondary school physics teaching,
- know and understand physics curricula and learning materials in secondary schools,
- master some specific didactics and physics developing concepts of secondary school physics,
- find and qualify for active implementation of secondary school legislation,
- upgrade knowledge on different ICT application in physics education,
- plan and use different methods and forms of teaching and imply them to physics class in secondary school,
- upgrade and synthesize additional knowledge to plan and execute class performance and other performance activities,
- evaluate class performance and assess student knowledge.

Prenesljive/ključne spretnosti in drugi atributi:

Študent usvoji spretnosti varnega snovanja in izvajanja eksperimentalnih vaj, razvija strokovno in informacijsko pismenost, usvoji kompetenco pisnega in verbalnega izražanja pred strokovno in laično javnostjo, predvsem podajanje znanja za različne razvojne stopnje.

Transferable/Key Skills and other attributes:

Student adopts the skills of safe design and implementation of experimental exercises, develops professional and informational literacy, adopts the competence of written and verbal expression in front of the professional and non professional public, and in particular providing knowledge for various stages of development.

Metode poučevanja in učenja:

Predavanje, razgovor in diskusija, demonstracija, metoda pisnih in grafičnih del, uporaba IKT, reševanje problemskih nalog in preiskovanje, ustvarjanje avtentičnih učnih situacij (mikro pouk), oblike dela (individualno delo, skupinsko delo - kooperativno učenje, timsko delo, delo v dvojicah, frontalno delo), delo z viri.

Learning and teaching methods:

Lecture, conversation and discussion, demonstration, method of written and graphic products, usage of ICT, problem solving and investigation, creation of authentic learning situations (micro teaching), learning forms (individual work, teamwork, group learning (cooperative learning, work in pair, frontal instruction), work with sources.

Poučevanje in učenje potekata z didaktično uporabo informacijsko-komunikacijske tehnologije.	Teaching and learning are done through the didactic use of ICT.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
- Portfolio s pisnimi izdelki (učne priprave, analize praktičnega pedagoškega dela, praktično pedagoško delo) - Opravljene laboratorijske vaje (priprave na vajo, izdelano poročilo laboratorijskih vaj ter zagovor, projektna naloga: izdelava in predstavitev) - Pisni in ustni izpit Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivno ocenjen portfolio in laboratorijske vaje z zagovorom so pogoj za pristop k pisnemu izpitu. Pozitivno ocenjen pisni izpit je pogoj za pristop k ustnemu izpitu.	30% 30% 40%	- Portfolio with student's works (preparations on lectures, analysis of practical pedagogical work; practical pedagogical work, seminar work). - concluded laboratory work (preparing on exercise, report of laboratory exercises and defense, project work: execution and presentation) - Written and oral exam. Each of the mentioned commitments must be assessed with a passing grade. Positive grade of portfolio and laboratory work and advocacy are a prerequisite for access to the written exam. Positive grade of written exam is a prerequisite for access to the oral exam

Reference nosilca / Lecturer's references:

- HAUKO, Robert, ANDREEVSKI, Damjan, PAUL, Domen, ŠTERK, Marko, REPNIK, Robert. Teaching of the harmonic oscillator damped by a constant force: The use of analogy and experiments. *American journal of physics : a publication of American association of physics teachers*, ISSN 0002-9505. [Print ed.], Sep. 2018, vol. 86, no. 9, str. 657-662, ilustr. https://aapt.scitation.org/doi/pdf/10.1119/1.5044654, doi: 10.1119/1.5044654.]
- REPNIK, Robert, SOVIČ, Magdalena. Didactical suitability of e-generated drill tests for physics. V: BILJANOVIĆ, Petar (ur.). Mipro proceedings, MIPRO 2016, 39th International Convention, May 30-June 3, 2016, Opatija, Croatia, (MIPRO ... (Tisak), ISSN 1847-3938). Rijeka: Croatian Society for Information and Communication Technology, Electronics and Microelectronics - MIPRO. cop. 2016, str. 962-965, ilustr. http://docs.mipro-proceedings.com/proceedings/mipro_2016_proceedings.pdf. [COBISS.SI-ID 22599432]doi: 10.26529/cepsj.322ŠORGO, Andrej, DOJER, Brina, GOLOB, Nika, REPNIK, Robert, REPOLUSK, Samo, PESEK, Igor, PLOJ VIRTIČ, Mateja, ŠPERNJAK, Andreja, ŠPUR, Natalija. Opinions about STEM content and classroom experiences as predictors of upper secondary school students'

career aspirations to become researchers or teachers. *Journal of research in science teaching*, ISSN 0022-4308, 2018, str. 1-21, ilustr., doi: doi.org/10.1002/tea.21462]