Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Didaktika astronomije
Course title:	Didactics of Astronomy

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	/	4	8
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
30		15	15	15	105	6

Nosilec predmeta / Lecturer:	dr. 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. Priporočljivo znanje: izkušnje z izvajanjem laboratorijskih in terenskih vaj, osnovna znanja iz	None. Recommended knowledge: Experiences in laboratory exercises and terrain work, basic knowledge of

mehanike in optike, osnove strokovnega pisanja, znanja iz astronomskih opazovanj	mechanics and optics, basics of scientific writing, knowledge of astronomical observations

Vsebina:	Content (Syllabus outline):
PR:	Lectures:
Pregled zgodovinskega razvoja astronomije in didaktike astronomije. (4)	Overview of the historical development of astronomy and didactics of astronomy. (4)
Pregled astronomskih objektov, pojmov in procesov: (6)	Overview of astronomical objects, phenomena and processes: (6)
- osnovni objekti v astronomiji (obravnava z večanjem oddaljenosti od Zemlje: Luna, Sonce, Sončev sistem, Galaksija, Lokalna jata...)	- basic objects in astronomy (teaching in sequence of increasing distance from the Earth: The Moon, Sun, Solar system, Galaxy, local cluster ...)
- velikostne predstave (razmerja velikosti objektov, razmerja oddaljenosti)	- dimensions conceptions (ratio of the size of objects, ratio of distances)
- povezave med objekti (komet - meteorski roj...)	- links between objects (comet - meteor showers ...)
- gibanja objektov v vesolju in posledice (dan-noč,letni časi, mrki...)	- movement of objects in space and consequences (day-night, seasons, eclipses ...)
- sodobne raziskave v astronomiji in možnosti za prenos informacij v pouk v osnovni in srednji šoli	- modern research in astronomy and the potential for transmission of information in teaching in elementary and secondary school
Opazovanja v astronomiji s poudarkom na izvedbi v šoli: (10)	Observations in astronomy with focus on execution of them in school: (10)
- orientacija na nebu, koordinatni sistemi, orientacija in razlaga v preteklosti	- orientation in the sky, coordinate systems, orientation and explanations in the past
- astronomski pripomočki zvezdna karta, astronomski atlas, efemeride; računalniški programi, IKT v astronomiji, internet; optični pripomočki: projekcije, binokularji, teleskopi; ostali pripomočki: sekstant, laser...	- astronomical Accessories star charts (Planisphere), astronomical atlas, ephemerides; computer programs, ICT in astronomy, internet; Optical devices: projections, binoculars, telescopes; other tools: sextant, laser...
- astronomska opazovanja s prostimi očmi:	
Luna: mene, vzhajanje in zahajanje, mrki; Sonce: vzhajanje in zahajanje, mrki; meteorji; planeti; svetlobna onesnaženost; priprava, organizacija in opremljenost za astronomsko opazovanje	- astronomical observations with naked-eyes: Moon: phases, rising and setting, eclipses; Sun: rising and setting, eclipses, meteors, planets, light pollution, preparation, organization and equipment for astronomical observation

- astronomska opazovanja z optičnimi pripomočki: postavitve, kolimiranje, umerjanje, napajanje teleskopov, Go-To funkcija; opazovanja objektov v Osončju, Messierjev katalog, NGC in drugi katalogi; fotografija in video v astronomiji, obdelava z računalnikom, filtri, kamere; spektroskopija, fotometrija, druge metode; večji teleskopi, nadatmosferski teleskopi, radijski teleskopi, južno nebo, informacijsko-komunikacijska tehnologija v astronomiji	- astronomical observation by optical devices: layout, collimation, calibration, power supply of telescopes, Go-To function, observation of objects in the solar system, Messier catalogue, NGC and other catalogues, photography and video in astronomy, processing with a computer, filters, cameras, spectroscopy, photometry, other methods ; larger telescopes, above-atmospheric telescopes, radio telescopes, Southern Sky, ICT and astronomy
Astronomija v izobraževalni vertikali: (10)	Astronomy in education vertical: (10)
- pregled astronomskih vsebin v kurikulumu rednih predmetov po izobraževalnih stopnjah od predšolske vzgoje do mature; druge možnosti: izbirni predmeti, raziskovalno in projektno delo, dnevi dejavnosti, tabori, društva in amaterska ter profesionalna astronomija	- review of astronomical content in the curriculum of regular subjects in education levels from pre-school till end of secondary school level; other possibilities: elective subjects, research and project work, activity days, camps, clubs and amateur and professional astronomy
- preverjanje in ocenjevanje pri poučevanju astronomskih vsebin	- testing and evaluation in teaching astronomy content
- razvoj naravoslovnih kompetenc in spretnosti pri poučevanju astronomskih vsebin	- development of science competences and skills in teaching astronomy content
- nivojsko zasnovano poučevanje astronomskih	- different level based teaching astronomical content (Kindergarten, 1st three-year, 4th and 5th grade, the subject of science, physics in 8th and 9th grade, secondary school level
vsebin (predšolska vzgoja, 1. triletje, 4. in 5. razred, predmet naravoslovje, fizika 8. in 9. razred, srednja šola	
- mladi raziskovalci v astronomiji	- young researchers in astronomy
SV:	Tutorial:
računske naloge (reševanje aplikativnih problemov)	calculus exercises (solving aplicative problems)
LV:	LW:
- IKT, astronomski multimedijski pripomočki, astronomija in internet	- ICT, astronomical multimedia devices, astronomy and internet
- določevanje dimenzij in oddaljenosti objektov v preteklosti in danes,	- determination of size and distance of objects in the past and today,
- uporaba fizikalnih zakonov v astronomiji in poučevanju astronomije: mehanika nebesnih teles, gravitacijski zakon, Newtonovi in Kepplerjevi zakoni,	- application of physical laws in astronomy and in teaching astronomy: mechanics of astronomical objects, the gravitational law, Newton's and Keppler's laws, conservation of physics quantities, nuclear

ohranitvene količine, jedrske reakcije, sevanje, Stefanov in Vienov zakon, Hubbleov zakon... - orientacija in koordinatni sistemi - uporaba astronomskih pripomočkov -izvedba dveh astronomskih učnih ur za različni izobraževalni stopnji TV: Izvesti osnovna astronomska opazovanja s praktično uporabo astronomskih pripomočkov: - organizacija astronomskih opazovanj v šoli - opazovanje Lune in Sonca - opazovanje planetov Osončja - izvedba osnovnih opazovanj s prostimi očmi - izvedba aktivnosti z uporabo astronomskih pripomočkov, - opazovanje svetlobne onesnaženosti na izbranem področju - izvedba opazovanj z optičnimi pripomočki izbranih astronomskih objektov globokega vesolja - pri opazovanju izbranega astronomskega objekta posneti astronomsko fotografijo in/ali video, računalniška obdelava - opazovanje meteorskega roja - izvedeno eno sistematično astronomsko opazovanje skozi daljši čas (Lunine mene, aktivnost Sonca, višina objekta v kulminaciji, analema, lune planetov, Venerine mene, Jupitrova rdeča pega in lune...) Projektna naloga: Samostojno delo: organizacija in sistematična izvedba kvantitativnih opazovanj izbranega	reactions, radiation, Stefan's and Vien's law, Hubble's law ... - orientation and coordinate systems - the use of astronomical accessories - implementation of two astronomical lessons for the different educational level FW Perform basic astronomical observation with practical use of astronomical accessories: - organization of astronomical observations in school - observation of the Moon and the Sun - observation of the solar system planets - implementation of basic naked-eye observations - the execution of activities with the use of astronomical accessories and tools - observation of light pollution in the selected area - implementation of an optical observations of selected astronomical deep-space objects - record astronomical photography and/or video of selected astronomical object, computer processing - observation of meteor shower - implementation of a long-time-period systematic astronomical observation (moon, sun activity, the culmination of astronomical objects, analema, moons of planets, Venus phases, Jupiter Red Spot an moons ...) Project Work: Independent work: organization and systematic execution of quantitative astronomical observations of selected astronomical object in the prescribed manner in simulation of educational process, the preparation of report.

astronomskega objekta na dogovorjen način v simulaciji izobraževalnega procesa, priprava poročila.	

Temeljni literatura in viri / Readings:

- Zwitter Tomaž, Pot skozi vesolje, Modrijan, Ljubljana, 2002
- Avsec France, Prosen Marijan, Astronomija, DMFA, Ljubljana, 2006
- Južnič Stanislav, Prosen Marijan, Astronomija na Slovenskem in slovenski astronomi na tujem, Didakta, Radovljica, 2008
- Strnad Janez, Mala zgodovina vesolja, DMFA, Ljubljana
- Chisolm Joanna in dr., Vesolje - velika ilustrirana enciklopedija, Mladinska knjiga, Ljubljana, 2008
- Sir Patrick Moore, The Amateur Astronomer (Patrick Moore's Practical Astronomy Series), Springer-Verlag London Ltd; 12Rev Ed edition (Oct 2005)
- Salaris, Maurizio, Evolution of stars and stellar populations, Chichester : J. Wiley, cop. 2005
- Vrtljiva zvezdna karta nt-BROG, 2011
- Druga astronomska periodika: Spika, Sky&Telescope, Weltraum und Sterne, Kmica ter astronomske in astrofizikalne znanstvene revije
- I. Gerlič. Didaktika pouka fizike v OŠ. PEF MB, 1992.
- I. Gerlič, V. Udir. Problemski pouk fizike v OŠ. Zavod RS za šolstvo, Ljubljana, 2006.
- Zaupanja vredni spletni viri, npr.: www.nasa.gov

Cilji in kompetence:	Objectives and competences:
Študenti usvojijo znanja s področja didaktike astronomije za prenos znanj na nivo, ki je primeren za poučevanje v osnovni in srednji šoli.	Students acquire knowledge in the field of didactics of astronomy for the transfer of knowledge and skills to a level suitable for teaching in primary and secondary school.

Predvideni študijski rezultati:	Intended learning outcomes:

Znanje in razumevanje:	Knowledge and understanding:
Po uspešno zaključeni učni enoti študent: • razume teme s področja didaktike astronomije, • pridobi sposobnost samostojne organizacije in varne izvedbe različnih astronomskih opazovanj, • uporabi znanje za natančno poročanje o izvedenih astronomski opazovanjih, • poveže znanje za pripravo pouka astronomskih vsebin na različnih izobraževalnih stopnjah, • uporablja računalniška orodja kot podporo pri poučevanju, • razvija naravoslovne kompetence .	On completion of this course student: • understands topics of didactics of astronomy in details, • gains ability to independentlyorganize and safely execute various astronomical observations, • uses knowledge to accurately report about executed observations, • connects knowledge to prepare teaching lessons of astronomical content in different educational levels, • uses computer and ICT as a support for teaching, • develops science competences.
Prenesljive/ključne spretnosti in drugi atributi: Strokovna in informacijska pismenost. Podajanje znanja za različne razvojne stopnje.	Transferable/Key Skills and other attributes: Scientific and informational literacy. Knowledge communication at different development stages.

Metode poučevanja in učenja:	Learning and teaching methods:
Multimedijska predavanja (razlaga, razgovor, demonstracija, uporaba simulacij in simulacijskih okolij) Vodeno eksperimentalno delo (metoda dela s tekstom, metoda pisnih in grafičnih del, metoda praktičnih del, uporaba simulacij in simulacijskih okolij) Problemsko učenje Terensko delo Individualno delo Elementi obrnjenega poučevanja Poučevanje in učenje potekata z didaktično uporabo informacijsko-komunikacijske tehnologije.	Multimedia lectures (explanation, discussion, demonstration, use of simulations and simulation environments) Guided experimental work (work with text, work with graphic elements, practical work, use of simulations and simulation environments), Problem-based learning Field work Individual work Elements of flipped learning Teaching and learning are done through the didactic use of ICT.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
a) ustni izpit b) pisni izpit c) izdelano poročilo laboratorijskih in terenskih vaj ter zagovor Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivno ocenjeno poročilo laboratorijskih in terenskih vaj ter zagovora in pozitivno opravljen pisni izpit sta pogoj za pristop k ustnemu izpitu.	a) 40 % b) 30 % c) 30 %	a) Oral exam b) Written exam c) Preparing report of laboratory work and field work and the oral avocation of experiments. Each of the mentioned commitments must be assessed with a passing grade. Positive grade of laboratory report and advocacy and positive grade of written exam are a prerequisite for access to oral examination.

Reference nosilca / Lecturer's references:

GRUBELNIK, Vladimir, MARHL, Marko, REPNIK, Robert. Determination of the size and depth of craters on the moon. *CEPS journal : Center for Educational Policy Studies Journal*, ISSN 1855-9719, 2018, vol. 8, no. 1, str. 35-53, ilustr., graf. prikazi.https://ojs.cepsj.si/index.php/cepsj/article/view/322/267, doi: 10.26529/cepsj.322. [COBISS.SI-ID 11968585], [SNIP, Scopus do 19. 5. 2018: št. citatov (TC): 0, čistih citatov (CI): 0]

OSRAJNIK, Damjan, REPNIK, Robert, KLEMENČIČ, Eva, GRUBELNIK, Vladimir. Cognitive processes and astronomy education - learning about the historical development of astronomy and astronautics. V: ABERŠEK, Boris (ur.), FLOGIE, Andrej (ur.). *4th International Scientific Conference on Philosophy of Mind and Cognitive Modelling in Education : conference abstract proceedings : September 25, 2020 Maribor, Slovenia*. Maribor: Zavod Antona Martina Slomška, 2020. Str. 24. ISBN 978-961-92190-8-9. https://en.calameo.com/read/005830753d9be1e874c21.KLEMENČIČ, Eva, REPNIK, Robert, OSRAJNIK, Damjan. Astronomske vsebine v e-učbeniku za osnovnošolsko fiziko. V: SLAVINEC, Mitja (ur.). Astronomi v Kmici : šestindvajsetič. Murska Sobota: AD Kmica, 2023. Str. 10-13, ilustr. ISBN 978-961-95235-3-7.

REPNIK, Robert, BERNAD, Peter, KRAŠNA, Marjan. Teaching physics using programming of simulations. V: SKALA, Karolj (ur.). MIPRO 2020 : 43nd International Convention, September 28 - October 2, 2020, Opatija, Croatia : mipro proceedings. Rijeka: Croatian Society for Information and Communication Technology, Electronics and Microelectronics - MIPRO, 2020. Str. 641-648, DOI: 10.23919/MIPRO48935.2020.9245274.

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