



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

Študijska smer

Letnik

Semester

Study programme and level

Study field

Academic year

Semester

<b>Enovit magistrski študijski program druge stopnje Predmetni učitelj</b>	/	3, 4	6, 8
<b>Five-year master's degree program Subject Teacher</b>	/		

Vrsta predmeta / Course type

Obvezni / Compulsory

Univerzitetna koda predmeta / University course code:

Predavanja	Seminar	Vaje	Lab. vaje	Terenske vaje	Samost. delo	ECTS
Lectures	Seminar	Tutorial	Laboratory work	Field work	Individ. work	
30		15	15	15	105	6

Nosilec predmeta / Lecturer:

dr. Robert Repnik

Jeziki / Predavanja / Lectures:

slovenski/Slovenian

Languages: Vaje / Tutorial:

slovenski/Slovenian

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

Pogojev ni.

None.

Priporočljivo znanje: izkušnje z izvajanjem laboratorijskih in terenskih vaj, osnovna znanja iz

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:

PR:

Pregled zgodovinskega razvoja astronomije in didaktike astronomije. (4)

Pregled astronomskih objektov, pojmov in procesov: (6)

- osnovni objekti v astronomiji (obravnavajo z večanjem oddaljenosti od Zemlje: Luna, Sonce, Sončev sistem, Galaksija, Lokalna jata...)

- velikostne predstave (razmerja velikosti objektov, razmerja oddaljenosti)

- povezave med objekti (komet - meteorski roj...)

- gibanja objektov v vesolju in posledice (dan-noč, letni časi, mrki...)

- sodobne raziskave v astronomiji in možnosti za prenos informacij v pouk v osnovni in srednji šoli

Opazovanja v astronomiji s poudarkom na izvedbi v šoli: (10)

- orientacija na nebu, koordinatni sistemi, orientacija in razlaga v preteklosti

- astronomski pripomočki: zvezdna karta, astronomski atlas, efemeride; računalniški programi, IKT v astronomiji, internet; optični pripomočki: projekcije, binokularji, teleskopi; ostali pripomočki: sekstant, 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

### Content (Syllabus outline):

Lectures:

Overview of the historical development of astronomy and didactics of astronomy. (4)

Overview of astronomical objects, phenomena and processes: (6)

- basic objects in astronomy (teaching in sequence of increasing distance from the Earth: The Moon, Sun, Solar system, Galaxy, local cluster ...)

- dimensions conceptions (ratio of the size of objects, ratio of distances)

- links between objects (comet - meteor showers ...)

- movement of objects in space and consequences (day-night, seasons, eclipses ...)

- modern research in astronomy and the potential for transmission of information in teaching in elementary and secondary school

Observations in astronomy with focus on execution of them in school: (10)

- orientation in the sky, coordinate systems, orientation and explanations in the past

- astronomical Accessories star charts (Planisphere), astronomical atlas, ephemerides; computer programs, ICT in astronomy, internet; Optical devices: projections, binoculars, telescopes; other tools: sextant, laser...

- 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

Astronomija v izobraževalni vertikali: (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

- preverjanje in ocenjevanje pri poučevanju astronomskih vsebin

- razvoj naravoslovnih kompetenc in spretnosti pri poučevanju astronomskih vsebin

- nivojsko zasnovano poučevanje astronomskih vsebin (predšolska vzgoja, 1. triletje, 4. in 5. razred, predmet naravoslovje, fizika 8. in 9. razred, srednja šola

- mladi raziskovalci v astronomiji

SV:

računske naloge (reševanje aplikativnih problemov)

LV:

- IKT, astronomski multimedijски pripomočki, astronomija in internet

- določevanje dimenzij in oddaljenosti objektov v preteklosti in danes,

- uporaba fizikalnih zakonov v astronomiji in poučevanju astronomije: mehanika nebesnih teles, gravitacijski zakon, Newtonovi in Keplerjevi zakoni,

- 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

Astronomy in education vertical: (10)

- 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

- testing and evaluation in teaching astronomy content

- development of science competences and skills in teaching astronomy content

- 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

- young researchers in astronomy

Tutorial:

calculus exercises (solving applicative problems)

LW:

- ICT, astronomical multimedia devices, astronomy and internet

- determination of size and distance of objects in the past and today,

- application of physical laws in astronomy and in teaching astronomy: mechanics of astronomical objects, the gravitational law, Newton's and Kepler'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 Wien'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 and 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](http://www.nasa.gov)

### Cilji in kompetence:

Študenti usvojijo znanja s področja didaktike astronomije za prenos znanj na nivo, ki je primeren za poučevanje v osnovni in srednji šoli.

### Objectives and competences:

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:

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**Znanje in razumevanje:**

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 .

**Prenesljive/ključne spretnosti in drugi atributi:**

Strokovna in informacijska pismenost.

Podajanje znanja za različne razvojne stopnje.

**Knowledge and understanding:**

On completion of this course student:

- understands topics of didactics of astronomy in details,
- gains ability to independently organize 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.

**Transferable/Key Skills and other attributes:**

Scientific and informational literacy. Knowledge

communication at different development stages.

**Metode poučevanja in učenja:**

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.**

**Learning and teaching methods:**

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.**

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

a) ustni izpit	a) 40 %	a) Oral exam
b) pisni izpit	b) 30 %	b) Written exam
c) izdelano poročilo laboratorijskih in terenskih vaj ter zagovor	c) 30 %	c) Preparing report of laboratory work and field work and the oral avocation of experiments.
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the mentioned commitments must be assessed with a passing grade.
Pozitivno ocenjeno poročilo laboratorijskih in terenskih vaj ter zagovora in pozitivno opravljen pisni izpit sta pogoj za pristop k ustnemu izpitu.		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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