Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Fizika**
Course title:	**Physics**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Enoviti magistrski študijski program druge stopnje Predmetni učitelj		**1**	**2**
Five-year master's degree program Subject Teacher		**1**	**2**

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	**30**		**15**		**105**	**6**

Nosilec predmeta / Lecturer: Aleš Fajmut

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
V celoti opravljene laboratorijske vaje so pogoj za pristop k teoretičnemu izpitu. Vsaka obveznost študenta v načinih ocenjevanja mora biti opravljena s pozitivno oceno.	Completed laboratory exercises are a prerequisite for taking the theoretical exam. Each student requirement within the assessment methods must be completed with a passing grade.

Vsebina:	**Content (Syllabus outline):**

Vsebina predavanj seminarjev in laboratorijskih vaj: 1. Osnove mehanike in biomehanike: kinematika, dinamika, statika in nihanje (mehansko in v bioloških sistemih); translacija in rotacija 2. Energija, energijski tokovi in regulacija temperature 3. Izbrani primeri iz elektrike in magnetizma 4. Zvok in svetloba: osnovne lastnosti snovnega in elektromagnetnega valovanja (EMV) ter njihova aplikacija v naravoslovju, tehniki in medicini; geometrijska optika 5. Atom in atomsko jedro: energijska stanja atomov in molekul, sevanje in absorpcija EMV v snovi; radioaktivnost, ionizirajoča sevanja; uporaba v naravoslovju, tehniki in medicini; 6. Metode slikanj in spektroskopij v naravoslovju, tehniki in medicini: razni mikroskopi in spektrometri, tomografske metode slikanj. 7. Osnove fizikalnih merjenj: metode merjenj, napake pri merjenjih, risanje diagramov, analiza rezultatov, reševanje osnovnih fizikalnih problemov. Laboratorijske vaje: študent samostojno ali v paru opravi 6-7 laboratorijskih vaj iz vsebin predavanj in seminarjev Seminar: sestoji iz zahtevnejših skupinskih in demonstracijskih eksperimentov, ki so podkrepljeni z računalniško analizo meritev in s praktičnimi ter računskimi zgledi	Contents of lectures, seminars and laboratory work: 1. Fundamentals of mechanics and biomechanics: kinematics, dynamics, statics and oscillations (mechanical and oscillations in biological systems); translational and rotational motion 2. Energy, energy flows and temperature regulation 3. Selected topics from electricity and magnetism 4. Sound and light: fundamental properties of material waves and electromagnetic waves (EMW) and their application in science, technology and medicine; geometrical optics. 5. Atom and nucleus: atom structure; energy states of atoms and molecules; radiation and absorption of EMW; radioactivity; ionising radiation; applications in science, technology and medicine. 6. Imaging and spectroscopy methods in science, technology and medicine: various microscopes and spectrometers, tomographic methods of imaging. 7. Fundamentals of measurements in physics: measuring methods, errors, drawing of diagrams, analysis of results, problem solving of fundamental assignments in physics. Laboratory work: student individually or in pairs works out 6-7 experimental assignments from the contents of lectures and seminar Seminar: consists of more demanding group and demonstration experiments supported by a computer-based analysis of measurements and problem solving assignments

Temeljni literatura in viri / Readings:

Newman, J. (2008). *Physics of the life sciences*. Springer.
Kladnik, R. (1985). *Visokošolska fizika. 1. del: Mehanski in toplotni pojavi*. DZS.
Kladnik, R. (1991). *Visokošolska fizika. 2. del: Elektrika, atomika*. DZS.
Kladnik, R. (1989). *Visokošolska fizika. 3. del: Akustika in optika – valovni pojavi*. DZS.
Giancoli, D. C. (1995). *Physics* (4th ed.). Prentice Hall.
Bohinc, K. (2014). *Fizika človeškega telesa*. Zdravstvena fakulteta, Univerza v Ljubljani.

Zapiski s predavanj ter navodila za vaje, ki so za študente dostopni na e-študijskem portalu UM: https://estudij.um.si/

Pojasnilo/Remark: Med temeljno študijsko literaturo sodijo samo tista poglavja iz omenjenih knjig, ki so del vsebine predmeta v okviru predavanj, seminarjev in laboratorijskih vaj. / Only those chapters from the abovementioned books that are considered within the syllabus outline of the course, including lectures, laboratory work and seminars, are regarded as core readings.

Cilji in kompetence:	**Objectives and competences:**
Študent je po uspešno opravljenem izpitu zmožen: - razumeti osnovne fizikalne teorije in zakone ter jih aplicirati na razlago pojavov in procesov v naravnem okolju, tehniki in živih bitjih s stališča fizike - strokovnega sodelovanja, komunikacije ter prenosa znanj s področja naravoslovja v interdisciplinarnem osnovnošolskem okolju	After passing the exam, the student is able: - to understand basic theories and laws from physics and to apply them to interpret the phenomena and processes involved in the natural environment, technology and living organisms from the physics point of view - of professional cooperation, communication and transfer of knowledge from the field of natural sciences in an interdisciplinary environment in primary schools
Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Po zaključku predmeta je študent zmožen: - kvalitativno in kvantitativno (s fizikalno-matematičnimi odvisnostmi) opisati obravnavane fizikalne zakone in teorije, jih aplicirati na posamezne konkretne probleme iz narave in tehnike ter jih rešiti - aplicirati vedenje o fizikalnih pojavih in procesih na konkretne osnovne primere uporabe v naravoslovju, tehniki in medicini - samostojno po navodilih pripraviti eksperiment za izbrane meritve, jih izvesti in kvantitativno analizirati izmerjene rezultate - pojasniti posamezne metode merjenja in analize izmerjenih podatkov ter predvideti posamezne rezultate **Prenesljive/ključne spretnosti in drugi atributi:** - sposobnost prepoznave problema in iskanja njegove osnovne teoretične in praktične rešitve v okviru elementarne fizike; - spretnosti za delo z izbrano merilno opremo - sposobnost osnovne kvantitativne analize izmerjenih rezultatov z računalniškimi orodji	**Knowledge and understanding:** Upon completion of the course, the student is able to: - qualitatively and quantitatively (with physical and mathematical dependencies) describe the physical laws and theories, apply them to particular problems from natural environment and technology and solve them - apply knowledge about physical phenomena and processes to specific basic uses in science, technology and medicine - independently prepare an experiment for selected measurements according to the instructions, perform them and quantify the measured results - explain individual methods of measurement and the analysis of measured data and predict some results **Transferable/Key Skills and other attributes:** - the ability to identify the problem and to find its basic theoretical and practical solution within elementary physics; - skills for working with selected measuring equipment - ability of basic quantitative analysis of measured data with computer tools

- sposobnost povezovanja vedenj znotraj naravoslovnih znanosti	- the ability to integrate knowledge within natural sciences

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, podkrepljena s simulacijami, animacijami in reševanjem problemov; seminar, ki zajema zahtevnejše skupinske in demonstracijske eksperimente, podkrepljene z računalniško analizo meritev; laboratorijske vaje (samostojno delo oz. delo v paru)	lectures, supported by simulations, animations and problem solving; seminar, which includes more demanding group and demonstration experiments, supported by a computer-based analysis of measurements; laboratory work (independent or in pairs)

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Teoretični izpit	80	Theoretical exam
Poročilo	20	Report

Opomba: teoretični izpit (v enakem deležu 80 %) je možno nadomestiti z dvema pisnima kolokvijema, katerih povprečje mora biti večje od 50 %, pri čemer posamezni rezultat ne sme biti manjši od 30 %. V primeru izpolnitve prvega pogoja in neizpolnitve drugega je za priznan pisni del izpita potreben dodatni ustni zagovor.

Note: The theoretical exam (contributing 80% of the final grade) can be replaced by two written midterm tests, whose average score must exceed 50 %, with neither individual score falling below 30 %. If the first condition is met but the second is not, an additional oral examination is required for the written part to be recognized.

Reference nosilca / Lecturer's references:

1. DOBOVIŠEK, Andrej, BLAŽEVIČ, Tina, KRALJ, Samo, FAJMUT, Aleš. Enzyme cascade to enzyme complex phase-transition-like transformation studied by the maximum entropy production principle. Cell reports physical science. 2025, vol. 6, iss. 2, [article no.] 102400, 11 str. ISSN 2666-3864. https://doi.org/10.1016/j.xcrp.2024.102400, [COBISS.SI-ID 225246211]
2. 2. DOBOVIŠEK, Andrej, VITAS, Marko, BLAŽEVIČ, Tina, MARKOVIČ, Rene, MARHL, Marko, FAJMUT, Aleš. Self-organization of enzyme-catalyzed reactions studied by the maximum entropy production principle. International journal of molecular sciences. 2023, vol. 24, iss. 10, 21 str. ISSN 1422-0067, DOI: 10.3390/ijms24108734 [COBISS.SI-ID 152729603]
3. FAJMUT, Aleš. Molecular mechanisms and targets of cyclic guanosine monophosphate (cGMP) in vascular smooth muscles. V: SAKUMA, Kunihiro (ur.). Muscle cell and tissue : novel molecular targets and current advances. London: IntechOpen, cop. 2021. Str. 1-31. ISBN 978-1-83968-651-1,

ISBN 978-1-83968-650-4, ISBN 978-1-83968-652-8. https://www.intechopen.com/chapters/76823,
DOI: 10.5772/intechopen.97708. [COBISS.SI-ID 79467011]