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
Univerzitetni študijski program Ekologija z naravovarstvom, 1. stopnja		1.	1.
Undergraduate university programme Ecology with Nature Conservation, 1st degree		1st	1st

Vrsta predmeta / Course type	Obvezni/Obligatory
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			**30**		**120**	**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:**
Ni pogojev.	None

Vsebina:	**Content (Syllabus outline):**
Elektromagnetno valovanje: spektri, izvori, lastnosti, absorpcija, sevanje, ekesperimentalne metode, ki temeljijo na odboju / absorpciji / emisiji / fluorescenci / sipanju EM valovanja, Beer-Lambertov zakon	Electromagnetic waves: EM spectrum, sources, properties, absorption, emission; experimental methods based on the detection of reflected/emitted/ absorbed/scattered/fluoresced EM waves, Beer-Lambert's law
Termodinamika: pretok snovi (difuzija, osmoza) in toplote oz. energije (prevajanje, konvekcija, sevanje), energijski tok metabolizma, regulacija temperature v človeškem telesu. Mehanika: statika in dinamika točkastih in togih teles; kinematski in dinamski pristop k obravnavi gibanja točkastih teles v 1D; vrtenje; sila, tlak, navor (vzvodi v človeškem telesu), delo, energija, moč; energijski zakon; deformacije (kosti); hidrostatika in hidrodinamika; aplikacije Brnoullijeve enačbe, viskoznost, Hagen - Poiseuilleov zakon, Reynoldsovo število; laminarni in turbulentni tokovi.	Thermodynamics: flow of matter (diffusion, osmosis) and heat/energy (conduction, convection, radiation); metabolic energy flow, regulation of body temperature Mechanics: statics and dynamics of particles. and rigid bodies; kinematic and dynamic approach to the study of motion in 1D; rotation; force; pressure; torque (levers in the human body), work, energy, power, conservation of energy, deformations (in bones); hydrostatics, hydrodynamics, applications of Bernoulli's equation, Hagen – Poiseuille's law, Reynolds's number; laminar turbulent flow
Nihanje: harmonske oscilacije (HO), dušene oscilacije, periodično vzbujanje v HO, oscilacije v bioloških in kemijskih sistemih, samovzdrževane oscilacije, stabilnost	Oscillations: harmonic oscillations (HO), damped HO, periodically forced HO, oscillations in biological and chemical systems, self-sustained oscillations, stability
Zvok: lastnosti zvočnega valovanja, spektri, interval slišnosti, občutljivost ušesa, intenziteta, analiza zvoka, ultrazvočno slikanje	Sound: properties, spectra, interval of hearing, sensitivity of human ear, intensity, analysis of the sound, ultrasound imaging
Moderna fizika: zgradba in model atoma, aplikacije radioaktivnosti in ionizirajočega sevanja, varnost pred sevanji	Modern physics: structure and model of the atom, applicability of radioactivity and ionizing radiation, safety
Električno in magnetno polje: Električna sila, polje, potencial (aplikacije v biologiji in medicini) magnetna sila in polje, gibanje nabitih delcev v E in M polju, katodna cev, rentgenska cev, masni spektrometer	Electric and magnetic (EM) field: electric - force, field, potential (applications in biology and medicine), magnetic - field, force; motion of charged particles in EM fields, cathode ray tube, roentgen apparatus and imaging, mass spectrometer
Študent opravi 10 laboratorijskih vaj s področij mehanike, termodinamike,	Student carries out 10 laboratory exercises from the fields of mechanics,

električnih in magnetnih pojavov, valovne in geometrijske optike, moderne fizike in radioaktivnosti. Vsebina vaj je aplicirana na biološke sisteme. Zahtevnejši eksperimenti se izvedejo skupinsko ali demonstracijsko.	thermodynamics, electric and magnetic phenomena, wave and geometric optics, modern physics and radioactivity. Lab work is applied to the study of biological systems. Advanced experiments are carried out in groups or as demonstration experiments.

Temeljni literatura in viri / Readings:

Obvezna literatura:
1. Jay Newman (2000) Physics of the Life Sciences, Springer, New York
2. Douglas C. Giancoli (1998) Physics principles with applications (5th ed. ali višja), Prentice Hall, Englewood Cliffs

Priporočena literatura:
3. Klemen Bohinc (2014) Fizika človeškega telesa, Zdravstvena fakulteta Univerze v Ljubljani, Ljubljana
Interna skripta in navodila za laboratorijske vaje, izročki prosojnic s predavanj in druga dodatna interna študijska literatura, ki je v elektronski obliki dostopna na: https://estudij.um.si/ v okviru predmeta Fizika.

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

Cilji in kompetence:	**Objectives and competences:**
Študent je po uspešno opravljenem izpitu zmožen: - razumeti obravnavane fizikalne teorije in zakone ter jih aplicirati na razlago pojavov in procesov v naravnem okolju, tehniki in v živih bitjih s stališča fizike - strokovnega sodelovanja, komunikacije ter prenosa znanj s področja naravoslovja v interdisciplinarnem okolju	After passing the exam, the student is able: - to understand selected theories and laws from physics and to apply them to interpret the phenomena and processes involved in the natural environment, technology and in 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

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 naravoslovja in tehnike ter jih rešiti - aplicirati vedenje o fizikalnih pojavih in procesih na konkretne osnovne primere uporabe v naravoslovju, tehniki in medicini	**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 science and technology and solve them

- 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 - izgraditi preproste izbrane fizikalno-matematične modele in z njimi napovedati rezultate	- 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 - build simple physical-mathematical models and to predict results with them
Prenesljive/ključne spretnosti in drugi atributi: - spretnosti za delo z izbrano merilno opremo - sposobnost osnovne kvantitativne analize izmerjenih rezultatov z računalniškimi orodji - sposobnost povezovanja vedenj znotraj naravoslovnih znanosti	**Transferable/Key Skills and other attributes:** - skills for working with selected measuring equipment - ability of basic quantitative analysis of measured data with computer tools - the ability to integrate knowledge within natural sciences

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, podkrepljena s simulacijami, animacijami, reševanjem problemov in z demonstracijskimi eksperimenti Laboratorijske vaje (v celoti opravljene laboratorijske vaje so pogoj za pristop h končnemu preizkusu znanja)	Lectures, supported by simulations, animations, problem solving and demonstration experiments Laboratory work (fully completed laboratory work is obligatory for the admittance to final examination)

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit iz vsebin predavanj in laboratorijskih vaj	70	Written exam from the contents of lectures and lab. work
Ustni zagovor iz vsebin predavanj in laboratorijskih vaj	30	Oral exam from the contents of lectures and lab. work
Opomba: pisni izpit je možno nadomestiti z dvema pisnima kolokvijema (iz vsebin predavanj in laboratorijskih vaj), katerih povprečje mora biti večje od 49%, 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: Written exam can be passed with two mid-term written tests (from the contents of lectures and laboratory work) with an average of more than 49%, with an individual score of not less than 30%. In case of the fulfilment of the first condition and the failure of another, an additional oral defence is required for the written exam treated as passed.

Reference nosilca / Lecturer's references:

1. DOBOVIŠEK, Andrej, MARKOVIČ, Rene, BRUMEN, Milan, FAJMUT, Aleš. The maximum entropy production and maximum Shannon information entropy in enzyme kinetics. Physica. A, Statistical mechanics and its applications, ISSN 0378-4371. [Print ed.], 2018, vol. 496, str. 220-232, doi: 10.1016/j.physa.2017.12.111. [COBISS.SI-ID 23601416],
2. DOBOVIŠEK, Andrej, VITAS, Marko, BRUMEN, Milan, FAJMUT, Aleš. Energy conservation and maximal entropy production in enzyme reactions. Biosystems, ISSN 0303-2647. [Print ed.], 2017, vol. 158, str. 47-56, doi: 10.1016/j.biosystems.2017.06.001. [COBISS.SI-ID 23218696]
3. FAJMUT, Aleš, EMERŠIČ, Tadej, DOBOVIŠEK, Andrej, ANTIĆ, Nataša, SCHÄFER, Dirk, BRUMEN, Milan. Dynamic model of eicosanoid production with special reference to non-steroidal anti-inflammatory drug-triggered hypersensitivity. IET systems biology, ISSN 1751-8849. [Print ed.], 2015, vol. 9, iss. 5, str. 204-215, doi: 10.1049/iet-syb.2014.0037. [COBISS.SI-ID 21404168]
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]