Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Mehanika**
Course title:	**Mechanics**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika, 1. stopnja		**1**	**1**
Physics, 1st cycle			

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		**30**			**120**	**7**

Nosilec predmeta / Lecturer: Nataša Vaupotič

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogojev ni. Priporočeno je predznanje maturitetnega programa matematike in fizike.	None. Knowledge on the level of the secondary school program of Physics and Mathematics is recommended for a successful work.

Vsebina:	**Content (Syllabus outline):**
	Kinematics and dynamics of motion, motion along a straight line, motion in two and three dimensions. Force, Newton laws. Kinetic energy and work, potential energy, conservative and dissipative forces, conservation of mechanical energy, conservation of energy.

Kinematika in dinamika gibanja točkastega telesa, premo in krivo gibanje. Sila, Newtonovi zakoni. Kinetična energija in delo sile, potencialna energija, delo konservativne sile, izrek o ohranitvi vsote kinetične in potencialne energije, delo nekonservativnih sil, zakon o ohranitvi energije. Sistemi delcev. Gibalna količina, sunek sile, zakon o ohranitvi gibalne količine. Elastični in neelastični trki v 1D in 2D. Vrtenje in kotaljenje: opis gibanja, kinetična energija pri vrtenju, vztrajnostni moment, navor, 2. Newtonov zakon za vrtenje. Vrtilna količina točkastega in razsežnega telesa, zakon o ohranitvi vrtilne količine. Ravnovesje togega telesa. Mehanika trdnih teles, ki se deformirajo. Gravitacija: gravitacijska sila, gravitacijska potencialna energija, Keplerjevi zakoni, gravitacija med obsežnimi telesi, plimske sile. Hidrodinamika: Tekočine: hidrostatični tlak, Pascalovo načelo, vezne posode, Arhimedov zakon, Bernoullijeva enačba, viskozne tekočine, Poiseuillov zakon, površinska napetost.	Systems of particles. Linear momentum, impulse, conservation of linear momentum. Elastic and noneleastic collisions in one and two dimensions. Rotation and rolling: kinematics, kinetic energy, rotational inertia, torque, Newton's second law in angular form. Angular momentum of a point particle and of a rigid body, conservation of angular momentum. Equilibrium and elasticity. Gravitation: gravitational force, gravitational energy, Kepler laws, gravitation between two large bodies, tides. Hydrodynamics: fluids, hydrostatic pressure, Pascal's principle, coupled vessels, Archimedes' law, Bernoulli's equation, viscosity, Poiseuille law, surface tension..

Temeljni literatura in viri / Readings:

1. D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics, poljubna izdaja, npr. 10. izdaja, (John Wiley & Sons, Inc., Hoboken, 2014).
2. J. Strnad, Fizika, 1. del, (DMFA, Ljubljana, 2002).
3. R. Kladnik, Visokošolska fizika. 1. del, Mehanski in toplotni pojavi (DZS, Ljubljana, 1985).
4. R. Kladnik, Visokošolska fizika. 3. del, Akustika in optika : valovni pojavi (DZS, Ljubljana, 1989).
5. Z. Bradač, Naloge iz fizike (Pedagoška fakulteta Maribor, 1991).
6. M. Gros, M. Hribar, A. Kodre, J. Strnad, Naloge iz fizike (DMFA, Ljubljana, 1991).
7. B. Majaron, M. Mikuž, A. Ramšak, Kolokvijske naloge iz fizike 1 (DMFA, Ljubljana, 1998).
8. J. Žitnik, Univerzitetne fizikalne naloge (TZS, Ljubljana, 2002-2003).

Cilji in kompetence:	**Objectives and competences:**
Študenti usvojijo temeljna teoretična znanja s področja mehanike in jih znajo uporabiti pri reševanju ustreznih problemov z rabo matematičnih orodij.	Students acquire basic theoretical knowledge from mechanics and are able to use it for solving problems with the use of mathematical tools.

Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje: Po uspešno zaključeni učni enoti bodo študenti sposobni - definirati fizikalni sistem, opredeliti dejavnike v okolici, ki vplivajo na stanje sistema, in kvalitativno ter kvantitativno napovedati spreminjanje stanja izbranega fizikalnega sistema v odvisnosti od parametrov in spremenljivk v sistemu in okolici; - uporabiti Newtonove zakone in ohranitvene zakone (zakoni o ohranitvi energije, gibalne in vrtilne količine) za analiziranje krivega gibanja, vrtenja, kotaljenja in gibanja astronomskih teles ter za določitev mehanskega ravnovesja togih in elastičnih teles; obravnavati laminarni tok idealne in viskozne tekočine ter napovedati gibanje teles skozi tekočino v odvisnosti od lastnosti telesa in tekočine. **Prenesljive/ključne spretnosti in drugi atributi:** Po uspešno zaključeni učni enoti bodo študenti zmožni: - uporabljati sodobno računalniško programsko opremo kot pomoč pri kvantitativnem računanju ter za izrisovanje odvisnosti med spremenljivkami v odvisnosti od vrednosti parametrov; - pripravljati miselne vzorce in skice ter smiselno poročati (vzrok/posledica) o izbrani temi; - uporabiti osnovno znanje linearne algebre in analize za obravnavo fizikalnih problemov.	**Knowledge and understanding:** On completion of this course students will be able to: - define a physical system, define the elements in the surrounding that affect the system and qualitatively and quantitatively predict changes of the system state as a function of parameters and variables defining the properties of the system and surrounding; - use Newton's laws and conservation laws (conservation of energy, linear momentum, angular momentum) to analyse translational motion in 3D, rotation and rolling and motion of astronomical bodies, as well as for defining the mechanical equilibrium of rigid and elastic bodies; - study lamellar flow of ideal and viscous fluids and predict a motion of bodies through a fluid as a function of the properties of the body and fluid. **Transferable/Key Skills and other attributes:** On completion of this course students will be able to: - use modern computer software for quantitative calculations and for plotting dependencies among variables at different values of parameters; - prepare mind flow charts and sketches and report (cause/consequence) on a selected topic; - use elementary knowledge from linear algebra and linear analysis to tackle physical problems.
Metode poučevanja in učenja:	**Learning and teaching methods:**

eksperimentalna predavanja teoretične vaje razlaga razgovor demonstracija delo s tekstom metoda pisnih in grafičnih del uporaba simulacij elementi obrnjenega poučevanja Poučevanje in učenje potekata z didaktično uporabo informacijsko-komunikacijske tehnologije.	lectures with experiments theoretical exercises explanation discussion demonstration work with text work with graphic elements use of simulations elements of flipped learning Teaching and learning are done through the didactic use of ICT.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt) pisni izpit (lahko se nadomesti z dvema pisnima kolokvijema) ustni izpit (lahko se nadomesti z dvema ustnima kolokvijema) Za uspešno zaključeno učno enoto mora vsak del posebej biti pozitiven.	 **50** **50**	Type (examination, oral, coursework, project): written exam (can be replaced by two written tests) oral exam (can be replaced by two oral tests) For a successfully finished course, both oral and written exams have to be positive.

Reference nosilca / Lecturer's references:

1. VAUPOTIČ, Nataša, POCIECHA, Damian, RYBAK, Paulina, MATRASZEK, Joanna, ČEPIČ, Mojca, WOLSKA, Joanna M., GÓRECKA, Ewa. Dielectric response of a ferroelectric nematic liquid crystalline phase in thin cells. *Liquid crystals*. [Online ed.]. [in press] 2023, 12 str. ISSN 1366-5855. DOI: 10.1080/02678292.2023.2180099. [COBISS.SI-ID 147790083]
2. GRABOVAC, Timon, GÓRECKA, Ewa, ZHU, Chenhui, POCIECHA, Damian, VAUPOTIČ, Nataša. Unmasking the structure of a chiral cubic thermotropic liquid crystal phase by a combination of soft and tender resonant X-ray scattering. *Soft matter*. Nov. 2022, vol. 18, iss. 42, str. 8194-8200, ilustr. ISSN 1744-6848. DOI: 10.1039/d2sm01030e. [COBISS.SI-ID 127668483]
3. POCIECHA, Damian, VAUPOTIČ, Nataša, MAJEWSKA, Magdalena, CRUICKSHANK, Ewan, WALKER, Rebecca, STOREY, John M. D., IMRIE, Corrie T., WANG, Cheng, GÓRECKA, Ewa. Photonic bandgap in achiral liquid crystals - a twist on a twist. *Advanced materials*. [Online ed.]. 2021, vol. 33, no. 39, str. 2103288-1-2103288-7. ISSN 1521-4095. DOI: 10.1002/adma.202103288. [COBISS.SI-ID 80061955]
4. GRABOVAC, Timon, GÓRECKA, Ewa, POCIECHA, Damian, VAUPOTIČ, Nataša. Modeling of the resonant X-ray response of a chiral cubic phase. *Crystals*. 2021, vol. 11, no. 2, str. 214-1-214-12. ISSN 2073-4352. DOI: 10.3390/cryst11020214. [COBISS.SI-ID 55156483]

5. LEWANDOWSKI, Wiktor, VAUPOTIČ, Nataša, POCIECHA, Damian, GÓRECKA, Ewa, LIZ-MARZÁN, Luis M. Chirality of liquid crystals formed from achiral molecules revealed by resonant X-ray scattering. *Advanced materials*. 2020, str. 1905591-1-1905591-17. ISSN 0935-9648. DOI: 10.1002/adma.201905591. [COBISS.SI-ID 20099843]