

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Tehniška fizika
Course title:	Technical physics
Članica nosilka/UL Member:	UL FS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Strojništvo - projektno aplikativni program, prva stopnja, visokošolski strokovni	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562657
Koda učne enote na članici/UL Member course code:	3002-V

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45		45			35	5

Nosilec predmeta/Lecturer:	Rok Petkovšek
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Vrsta predmeta/Course type:	Obvezni splošni predmet / Compulsory general course/Compulsory general course
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Izpolnjevanje pogojev za vpis v Visokošolski strokovni študijski program I. stopnje Strojništvo - Projektno aplikativni program.	Meeting the enrollment conditions for the MECHANICAL ENGINEERING - Project Oriented Applied Programme.

Vsebina:	Content (Syllabus outline):
1. Predavanje: Uvod - Predstavitev dela pri predmetu - Predstavitev predmeta - Uvod - Osnovne enote - Opazovanje in eksperiment - Zgradba snovi 2. Predavanje: Kinematika - Opis gibanja - Premik, hitrost, pospešek	Lecture 1: Introduction - Presentation of assignments - Presentation of the course - Introduction - Basic units - Observation and experiment, - The structure of matter Lecture 2: Kinematics - Description of movement

<ul style="list-style-type: none"> - Grafi gibanja - Enakomerno pospešeno gibanje v 1d - Enakomerno pospešeno gibanje v prostoru - Sile <p>3. Predavanje: Dinamika</p> <ul style="list-style-type: none"> - Newtonovi zakoni - Primeri sil - Uporaba Newtonovih zakonov - Delo sile - Konservativne in nekonvativne sile <p>4. Predavanje: Energija in gibalna količina</p> <ul style="list-style-type: none"> - Potencialna energija - Kinetična energija - Izrek o mehanski energiji - Moč - Gibalna količina in sunek sile - Ohranitev gibalne količine - Trki - Raketni pogon <p>5. Predavanje: Vrtenje</p> <ul style="list-style-type: none"> - Opis kroženja točke - Centripetalni pospešek - Ubežna hitrost - Gibanje togega telesa - Navor in vztrajnostni moment - Sinek navora in vrtilna količina <p>6. Predavanje: Tekočine</p> <ul style="list-style-type: none"> - Agregatna stanja - Prožnost - Tlak in vzgon - Površinska energija - Bernoullijeva enačba - Uporaba Bernoullijeve enačbe <p>7. Predavanje: Temperatura in toplota</p> <ul style="list-style-type: none"> - Temperatura - Temperaturno raztezanje - Makroskopski opis idealnega plina - Toplota in notranja energija - Specifična toplota - Kalorimetrija - Latentna toplota in fazne spremembe - Prevajanje in sevanje <p>8. Predavanje: Termodinamika</p> <ul style="list-style-type: none"> - Delo pri termodinamskih procesih - Prvi zakon termodinamike - Termodinamski procesi - Toplotni stroji - Entropija - Drugi zakon termodinamike <p>9. Predavanje: Nihanje in valovanje</p> <ul style="list-style-type: none"> - Harmonsko nihanje - Mehanska nihala - Energija nihanja - Harmonsko valovanje 	<ul style="list-style-type: none"> - Displacement, velocity, acceleration - Motion graphs - Motion with constant acceleration in 1D - Motion with constant acceleration in 3D - Forces <p>Lecture 3: Dynamics</p> <ul style="list-style-type: none"> - Newton's laws - Examples of forces - Application of Newton's Laws - Work done by a force - Conservative and non-conservative forces <p>Lecture 4: Energy and momentum</p> <ul style="list-style-type: none"> - Potential energy - Kinetic energy - Mechanical energy theorem - Power - Momentum and impulse - Conservation of momentum - Collisions - Rocket propulsion <p>Lecture 5: Rotation</p> <ul style="list-style-type: none"> - Description of circular motion - Centripetal acceleration - Escape velocity - Motion of a rigid body - Torque and moment of inertia - Torque impulse and angular momentum <p>Lecture 6: Fluids</p> <ul style="list-style-type: none"> - States of matter - Elasticity - Pressure and buoyancy - Surface energy - Bernoulli's equation - Using the Bernoulli equation <p>Lecture 7: Temperature and heat</p> <ul style="list-style-type: none"> - Temperature - Temperature expansion - Macroscopic description of the ideal gas - Heat and internal energy - Specific heat - Calorimetry - Latent heat and phase changes - Heat conduction and radiation <p>Lecture 8: Thermodynamics</p> <ul style="list-style-type: none"> - Work in thermodynamic processes - The first law of thermodynamics - Thermodynamic processes - Heat engines - Entropy - The second law of thermodynamics <p>Lecture 9: Oscillation and waves</p>
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<ul style="list-style-type: none"> - Odboj in lom - Interferenca in uklon 	<ul style="list-style-type: none"> - Harmonic oscillation - Mechanical pendulums
10. Predavanje: Zvok	- Energy of oscillation
<ul style="list-style-type: none"> - Nastanek zvočnih valov - Značilnosti zvočnih valov - Hitrost zvoka - Jakost in glasnost zvoka - Krogelni in ravni valovi - Stoječe valovanje v piščali 	<ul style="list-style-type: none"> - Harmonic waves - Reflection and refraction - Interference and diffraction
11. Predavanje: Električna	Lecture 10: Sound
<ul style="list-style-type: none"> - Lastnosti električnega naboja - Izolatorji in prevodniki - Coulombov zakon - Električno polje - Delo električne sile in električna napetost - Kondenzator - Električni tok - Upornost, specifična upornost - Električna energija in moč 	<ul style="list-style-type: none"> - Sound waves - Sound wave characteristics - Speed of sound - Intensity of sound - Spherical and plane waves - Standing wave in a pipe
12. Predavanje: Magnetizem	Lecture 11: Electricity
<ul style="list-style-type: none"> - Magnetne sile in navori - Magnetna poljska gostota - Tuljava - Snov v magnetnem polju - Gibanje vodnika v magnetnem polju - Indukcija - Izmenična napetost - Transformator 	<ul style="list-style-type: none"> - Electrical charge properties - Isolators and conductors - Coulomb's law - Electric field - Work of electric force and voltage - Capacitor - Electric current - Resistance, specific resistance - Electric energy and power
13. Predavanje: Svetloba in geometrijska optika	Lecture 12: Magnetism
<ul style="list-style-type: none"> - Spekter EM valovanja - Hitrost svetlobe - Odboj in lom - Predmet in slika - Krogelna ogledala - Tanke leče - Enačba optične preslikave - Lečje 	<ul style="list-style-type: none"> - Magnetic forces and torques - Magnetic field density - Coil - Matter in a magnetic field - Movement of conductor in magnetic field - Induction - AC power - Transformer
14. Predavanje: Valovna optika in optični instrumenti	Lecture 13: Light and geometrical optics
<ul style="list-style-type: none"> - Youngov poskus - Uklonska mrežica - Uklon na reži - Polarizacija svetlobe - Optični instrumenti - Kotna ločljivost 	<ul style="list-style-type: none"> - EM wave spectrum - The speed of light - Reflection and refraction - Object and picture - Spherical mirrors - Thin lenses - Optical imaging equation - Combination of lenses
15. Predavanje: Moderna fizika	Lecture 14: Wave optics and optical instruments
<ul style="list-style-type: none"> - Fotoelektrični pojav - Rentgenski žarki - Rutherfordov model atoma - Vodikov atom - Atomske spektri - Laser - Zgradba jedra - Vezavna energija - Radioaktivnost 	<ul style="list-style-type: none"> - Young's experiment - Optical grating - Refraction on a single slit - Light polarization - Optical instruments - Angular resolution
	Lecture 15: Modern physics
	<ul style="list-style-type: none"> - Photoelectric phenomenon - X-rays

<ul style="list-style-type: none"> - Jedrske reakcije - Jedrska energija 	<ul style="list-style-type: none"> - Rutherford's model of atoms - Hydrogen atom - Atomic spectra - Laser - Structure of atomic nucleus - Binding energy - Radioactivity - Nuclear reactions - Nuclear power
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Temeljna literatura in viri/Readings:

C. Vuille, R. A. Serway, "College Physics", Brooks Cole, 8. izdaja 2010

C. Vuille, R. A. Serway, "College Physics", Brooks Cole, 2008 - posebna izdaja za študente FS, Brooks Cole, 2009

I. Grabec, »Predavanja iz fizike«, UL FS, 2004

Cilji in kompetence:

Cilji:

Spoznavanje fizikalnih vsebin, po programu

Uporaba fizikalnega znanja za reševanje računskih nalog iz obravnavanih vsebin

Predstavitev obravnavanega fizikalnega problema (naloge) v pisni obliki.

Predstavitev obravnavanega fizikalnega problema (naloge) drugim študentom v skupini.

Uporaba drugih virov (poleg predpisane literature) za reševanje problemov/nalog.

Razumevanje pomena ustreznega podajanja strokovnih vsebin (profesionalna odgovornost)

Spoznavanje in samostojna izvedba izbranih preprostih meritev.

Razumevanje povezave med fizikalnimi principi in okoljskimi omejitvami.

Kompetence:

P1-PAP, S1-PAP: Razumevanje fizikalnih principov in sposobnost njihove uporabe za analizo konkretnih problemov v praksi.

S5-PAP: Razvijanje sposobnosti kritičnega mišljenja pri obravnavi tehniških problemov.

S10-PAP: Sposobnost strokovnega sporazumevanja in izražanja.

S11-PAP: Sposobnost predstavitve strokovnih problemov in njihovih rešitev.

S13-PAP: Sposobnost iskanja potrebnih virov znanja, njihove uporaba in selekcija.

Objectives and competences:

Objectives:

Getting to know the physical contents, according to the program

Use of physical knowledge to solve computational tasks from the contents discussed

Presentation of the physical problem (task) in writing.

Presentation of the discussed physical problem (task) to other students in the group.

Using other sources (besides the prescribed literature) to solve problems / tasks.

Understanding the importance of applying professional content properly (professional responsibility)

Getting to know and performing selected simple measurements independently.

Understanding the connection between physical principles and environmental constraints.

Competencies:

P1-PAP, S1-PAP: Understanding of physical principles and ability to apply them to the analysis of concrete problems in practice.

S5-PAP: Developing critical thinking skills in dealing with technical issues.

S10-PAP: Ability to communicate and express professionally.

S11-PAP: Ability to present professional problems and their solutions.

S13-PAP: Ability to find, use and select the necessary

S15-PAP: Razvijanje profesionalne odgovornosti.	knowledge resources.
P4-PAP: Poznavanje fizikalnih osnov merjenja na tehniškem področju.	S15-PAP: Developing professional responsibility.
P5-PAP: Poznavanje fizikalnih razlogov za glavne okoljske omejitve in probleme.	P4-PAP: Knowledge of the physical basics of measurement in the technical field.
	P5-PAP: Knowing the physical causes of major environmental constraints and problems.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanja:	Knowledge:
Z1: Poglobljeno strokovno teoretično in praktično znanje uporabe fizikalnih principov na tehniškem področju.	Z1: In-depth professional theoretical and practical knowledge of the application of physical principles in the technical field.
Spretnosti:	Skills:
S1.3 Diagnosticiranje in reševanje problemov na tehniškem področju z uporabo osnovnih fizikalnih principov.	S1.3 Diagnosing and solving problems in the technical field using basic physical principles.
S1.4 Osnova za izvirna dognanja in kritično refleksijo na tehniškem področju z uporabo osnovnih fizikalnih principov.	S1.4 Basis for original findings and critical reflection in the technical field, using basic physical principles.

Metode poučevanja in učenja:

Learning and teaching methods:

P1 Avditorna predavanja z reševanjem izbranih - za področje značilnih - teoretičnih in praktično uporabnih primerov.	P1 Lectures with solving of selected typical theoretical and practical examples.
P2 Obravnava snovi po urejeni in vnaprej razloženi sistematiki.	P2 Treatment of the discussed content in an orderly and pre-interpreted systematic manner.
P3 Avditorne vaje, kjer se teoretično znanje s predavanj podkrepí z računskimi primeri.	P3 Practical classes where theoretical knowledge from lectures is supported by computational examples.
P4 Laboratorijske vaje z namenski didaktični pripomočki (osnovni mehanski, električni, optični itd. merilniki).	P4 Laboratory exercises with dedicated teaching aids (basic mechanical, electrical, optical, etc.).
P5 Uporaba študijskega gradiva v obliki knjige, skript, zapiskov, e-knjige.	P5 Use of study materials in the form of books, scripts, notes, e-books.
P6 Interaktivna predavanja.	P6 Interactive Lectures.

Načini ocenjevanja:

Delež/Weight

Assessment:

Skupno oceno predmeta tvorita ocena teorije in vaj. Ocena teorije: - Teoretični del: 100%.	50,00 %	The overall course grade consists of grade for theory and grade for exercises. Theory grade: - Theoretical part: 100%.
Ocena vaj: - Računski del: 80%.	40,00 %	Exercise grade: - Computational: 80%.
- Praktični del (Laboratorij): 20%.	10,00 %	Practical (Laboratory): 20%.

Reference nosilca/Lecturer's references:

Rok Petkovšek:

1. MUR, Jaka, **PETKOVŠEK, Rok**. Precision and resolution in laser direct microstructuring with bursts of picosecond pulses. Applied physics.A, Materials science & processing. Jan. 2018, vol. 124, str. 1-6, ilustr. ISSN 0947-8396. <https://link.springer.com/content/pdf/10.1007%2Fs00339-017-1490-4.pdf>, DOI: [10.1007/s00339-017-1490-4](https://doi.org/10.1007/s00339-017-1490-4). [COBISS.SI-ID 15822107]
2. MUR, Jaka, PETELIN, Jaka, OSTERMAN, Natan, **PETKOVŠEK, Rok**. High precision laser direct microstructuring system based on bursts of picosecond pulses. Journal of physics.D, Applied physics. 2017, vol. 50, f. 1-7, ilustr. ISSN 0022-3727. <http://iopscience.iop.org/article/10.1088/1361-6463/aa7b5a/pdf>, DOI: [10.1088/1361-6463/aa7b5a](https://doi.org/10.1088/1361-6463/aa7b5a). [COBISS.SI-ID 15571227]
3. ŠAJN, Marko, PETELIN, Jaka, AGREŽ, Vid, VIDMAR, Matjaž, **PETKOVŠEK, Rok**. DFB diode seeded low repetition rate fiber laser system operating in burst mode. Optics and laser technology. [Print ed.]. Feb. 2017, vol. 88, str. 99-103, ilustr. ISSN 0030-3992. <http://www.sciencedirect.com/science/article/pii/S0030399216306247>, DOI: [10.1016/j.optlastec.2016.09.006](https://doi.org/10.1016/j.optlastec.2016.09.006). [COBISS.SI-ID 14904091]
4. MUR, Jaka, PIRKER, Luka, OSTERMAN, Natan, **PETKOVŠEK, Rok**. Silicon crystallinity control during laser direct microstructuring with bursts of picosecond pulses. Optics express. Oct. 2017, vol. 25, nr. 21, str. 26356-26364, ilustr. ISSN 1094-4087. https://www.osapublishing.org/DirectPDFAccess/729EF770-F82D-AD9E-CCEF9E7C49995950_375271/oe-25-21-26356.pdf?da=1&id=375271&seq=0&mobile=no, DOI: [10.1364/OE.25.026356](https://doi.org/10.1364/OE.25.026356). [COBISS.SI-ID 15709467]
5. PETELIN, Jaka, PODOBNIK, Boštjan, **PETKOVŠEK, Rok**. Burst shaping in a fiber-amplifier chain seeded by a gain-switched laser diode. Applied optics. Tiskana izd. May 2015, vol. 54, iss. 15, str. 4629-4634, ilustr. ISSN 1559-128X. DOI: [10.1364/AO.54.004629](https://doi.org/10.1364/AO.54.004629). [COBISS.SI-ID 14072603]