

# TEHNIŠKA FIZIKA

## UČNI NAČRT PREDMETA/COURSE SYLLABUS

<b>Predmet:</b>	Tehniška fizika
<b>Course title:</b>	Technical Physics
<b>Članica nosilka/UL Member:</b>	UL FS

<b>Študijski programi in stopnja</b>	<b>Študijska smer</b>	<b>Letnik</b>	<b>Semestri</b>	<b>Izbirnost</b>
Strojništvo - projektno aplikativni program, prva stopnja, visokošolski strokovni (od študijskega leta 2025/2026 dalje)	Ni členitve (študijski program)	1. letnik	1. semester	obvezni

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

<b>Predavanja /Lectures</b>	<b>Seminar /Seminar</b>	<b>Vaje /Tutorials</b>	<b>Klinične vaje /Clinical tutorials</b>	<b>Druge oblike študija /Other forms of study</b>	<b>Samostojno delo /Individual student work</b>	<b>ECTS</b>
45		45			35	5

<b>Nosilec predmeta/Lecturer:</b>	Rok Petkovšek
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<b>Izvajalci predavanj:</b>	
<b>Izvajalci seminarjev:</b>	
<b>Izvajalci vaj:</b>	
<b>Izvajalci kliničnih vaj:</b>	
<b>Izvajalci drugih oblik:</b>	

**Izvajalci praktičnega usposabljanja:**

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**Vrsta predmeta/Course type:**

Obvezni splošni predmet / Compulsory general course/Compulsory general course

**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
  - Grafi gibanja
  - Enakomerno pospešeno gibanje v 1d
  - Enakomerno pospešeno gibanje v prostoru
  - Sile
3. Predavanje: Dinamika
  - Newtonovi zakoni
  - Primeri sil
  - Uporaba Newtonovih zakonov
  - Delo sile
  - Konservativne in nekonservativne sile
4. Predavanje: Energija in gibalna količina
  - Potencialna energija
  - Kinetična energija
  - Izrek o mehanski energiji
  - Moč
  - Gibalna količina in sunek sile
  - Ohranitev gibalne količine

- 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
  - Displacement, velocity, acceleration
  - Motion graphs
  - Motion with constant acceleration in 1D
  - Motion with constant acceleration in 3D
  - Forces
- Lecture 3: Dynamics
- Newton's laws
  - Examples of forces
  - Application of Newton's Laws
  - Work done by a force
  - Conservative and non-conservative forces
- Lecture 4: Energy and momentum
- Potential energy
  - Kinetic energy
  - Mechanical energy theorem
  - Power

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

1. C. Vuille, R. A. Serway, "College Physics", Brooks Cole, 8. izdaja 2010, [COBISS.SI-ID [10502939](#)]
2. C. Vuille, R. A. Serway, "College Physics", Brooks Cole, 2008 - posebna izdaja za študente FS, Brooks Cole, 2009, [COBISS.SI-ID [10773787](#)]
3. I. Grabec, »Predavanja iz fizike«, UL FS, 2004, [COBISS.SI-ID [216088064](#)]

### 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

### 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.

<p>virov znanja, njihove uporaba in selekcija.</p> <p>S15-PAP: Razvijanje profesionalne odgovornosti.</p> <p>P4-PAP: Poznavanje fizikalnih osnov merjenja na tehniškem področju.</p> <p>P5-PAP: Poznavanje fizikalnih razlogov za glavne okoljske omejitve in probleme.</p>	<p>S13-PAP: Ability to find, use and select the necessary knowledge resources.</p> <p>S15-PAP: Developing professional responsibility.</p> <p>P4-PAP: Knowledge of the physical basics of measurement in the technical field.</p> <p>P5-PAP: Knowing the physical causes of major environmental constraints and problems.</p>
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**Predvideni študijski rezultati:**

**Intended learning outcomes:**

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

**Learning and teaching methods:**

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

**Delež/ Assessment:**

## Weight

Skupna ocena predmeta je sestavljena:		The overall course grade consists of two parts:
Teoretični del	36,00 %	Theory part
Ocena vaj (računski in praktični del)	64,00 %	Exercise grade (computational and practical)

### Ocenjevalna lestvica:

### Grading system:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10
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### 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](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](#)]