

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Napredni materiali
<b>Course title:</b>	Advanced materials

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Tehnologije in sistemi – prva stopnja	Tehnologije in sistemi	tretji	zimski
Technologies and systems – 1st cycle	Technologies and systems	third	winter

**Vrsta predmeta / Course type** izbirni/elective

**Univerzitetna koda predmeta / University course code:** TS M2 UN2

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Laboratorijske vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		15	15		100	6

**Nosilec predmeta / Lecturer:** Doc. dr. Gorazd Hlebanja

**Jeziki / Languages:**

<b>Predavanja / Lectures:</b>	slovenski/Slovenian
<b>Vaje / Tutorial:</b>	slovenski/Slovenian

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

- vpis v tretji letnik študija

**Prerequisites:**

- enrollment in the third year of study

**Vsebina:**

- *Uvod.*
- *Napredni nekovinski materiali (polimeri, keramika).* Zgradba, osnovne značilnosti, prednosti in slabosti, mehanizmi porušitve. Področja uporabe in funkcionalne lastnosti.
- *Kompoziti (kompoziti na osnovi kovinske matrice, kompoziti na osnovi nekovinske matrice).* Klasifikacija kompozitnih materialov. Zgradba, osnovne značilnosti, mehanizmi ojačitve, prednosti in slabosti, mehanizmi porušitve. Področja uporabe in funkcionalne lastnosti.

**Content (Syllabus outline):**

- *Introduction.*
- *Advanced non-metallic materials (polymers, ceramics).* Construction, basic properties, advantages and disadvantages, collapse mechanisms. Fields of application and functional properties.
- *Composites (composites based on a metallic matrix, composites based on a non-metallic matrix).* Classification of composite materials. Structure, basic properties, reinforcement mechanisms, advantages and disadvantages, collapse

- *Biomateriali*. Vrste in osnovne značilnosti, biološke lastnosti, prednosti in slabosti. Področja uporabe in funkcionalne lastnosti.
- *Materiali prihodnosti (pametni materiali, nanostrukturirani materiali)*. Zgradba, osnovne značilnosti, prednosti in slabosti. Metode izdelave nanostrukturiranih materialov. Področja uporabe in funkcionalne lastnosti.

mechanisms. Fields of application and functional properties.

- *Biomaterials*. Types and basic characteristics, biological properties, advantages and disadvantages. Fields of application and functional properties.
- *Materials of the future (smart materials, nanostructured materials)*. Construction, basic properties, advantages and disadvantages. Methods of manufacturing nanostructured materials. Fields of application and functional properties.

### Temeljni literatura in viri / Readings:

- [1] Callister Jr, W. D. (2007). *Materials Science and Engineering*, John Wiley & Sons, Inc, New York.
- [2] Gay, D., Hoa, S. V., & Tsai, S. W. (2002). *Composite materials: design and applications*. CRC press.
- [3] Ong, J. L., Appleford, M. R., & Mani, G. (2014). *Introduction to biomaterials: basic theory with engineering applications*. Cambridge University Press.
- [4] Abramovich, H. (2016). *Intelligent Materials and Structures*. Walter de Gruyter GmbH & Co KG.
- [5] Koch, C. C. (2006). *Nanostructured materials: processing, properties and applications*. William Andrew.

### Cilji in kompetence:

*Učna enota prispeva k razvoju naslednjih specifičnih kompetenc:*

- razumevanju fizikalnih principov obnašanja naprednih materialov,
- poznavanju morfoloških, mehanskih in drugih fizikalnih lastnosti materialov,
- sposobnosti kvalitativnega povezovanja makroskopskih lastnosti z danimi strukturnimi lastnostmi na nano in mikro skali,
- poznavanju funkcionalnih lastnosti naprednih materialov,
- poznavanju prednosti in slabosti uporabe posamezne skupine naprednih materialov,
- sposobnosti izbire ustreznih materialov glede na področje uporabe in zahtevane funkcionalne lastnosti.

*Učna enota prispeva k razvoju naslednjih splošnih kompetenc:*

### Objectives and competences:

*The learning unit contributes to the development of the following specific competences:*

- understanding the physical principles of the behavior of advanced materials,
- knowledge of morphological, mechanical and other physical properties of materials,
- the ability to qualitatively connect macroscopic properties with given structural properties on the nano and micro scale,
- knowledge of the functional properties of advanced materials,
- knowing the advantages and disadvantages of using each group of advanced materials,
- the ability to choose appropriate materials according to the field of application and the required functional properties.

*The learning unit contributes to the*

- sposobnosti identifikacije tehničnega problema ter načrtovanje njegovega reševanja,
- sposobnosti matematičnega razumevanja tehničnih problemov in uporaba matematike pri reševanju le-teh,
- sposobnosti uporabe pridobljenega teoretičnega znanja v praksi,
- sposobnosti interdisciplinarnega povezovanja znanja,
- sposobnosti kritične presoje.

*development of the following general competences:*

- the ability to grasp and analyse a problem, as well as foresee operational solutions in the technological sense or in the process of organisation and management,
- the ability to understand technical problems mathematically and solve them with the help of mathematics,
- the ability to use acquired theoretical knowledge in practice,
- the ability to integrate knowledge in an interdisciplinary manner,
- critical judgment ability.

**Predvideni študijski rezultati:**

- Študenti razumejo kvalitativne povezave med makroskopskimi lastnostmi in strukturo naprednih materialov.
- Poznajo mehanizme, ki so odgovorni za obnašanje na različnih velikostnih skalah opazovanja, ter osnovne mehanizme porušitve naprednih materialov.
- Razumejo pomembnost poznavanja lastnosti uporabljenih materialov in mehanike pri načrtovanju konstrukcij.
- Poznajo osnovne znanstvene in tehnološke vidike naprednih materialov in pripadajočih procesov.
- Z vidika uporabe znajo opredeliti vrsto naprednega materiala, ki izkazuje želene funkcionalne lastnosti.

**Intended learning outcomes:**

Knowledge and understanding:

Student:

- understands the qualitative relationships between the macroscopic properties and structure of advanced materials.
- knows the mechanisms responsible for the behaviour at different scales of observation and the basic mechanisms of failure of advanced materials.
- understands the importance of knowing the properties of the materials used and the mechanics involved in the design of structures.
- Is familiar with the basic scientific and technological aspects of advanced materials and related processes.
- knows how to define the type of advanced material that has the desired functional properties, from an application point of view.

**Metode poučevanja in učenja:**

- predavanja in vaje z aktivno udeležbo študentov
- seminarske naloge

**Learning and teaching methods:**

- lectures and tutorials with active participation of students
- seminar assignments

<b>Načini ocenjevanja:</b>	Delež (v %) / Weight (in %)	<b>Assessment:</b>
Način (pisni izpit, ustno izpraševanje, naloge, projekt): <ul style="list-style-type: none"> <li>• pisni izpit</li> <li>• ustni izpit</li> <li>• projektno in seminarsko delo</li> </ul> Ocenjevalna lestvica: ECTS.	40% ocene 40% ocene 20% ocene	Type (examination, oral, coursework, project): <ul style="list-style-type: none"> <li>• written exam</li> <li>• verbal exam</li> <li>• project and seminar work</li> </ul> Grading scale: ECTS.