

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Vakuumska tehnologija
Course title:	Vacuum technology

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	peti
Technologies and systems – 1st cycle	Technologies and systems	third	fifth

Vrsta predmeta / Course type modularni/modular

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		30		30	70	6

Nosilec predmeta / Lecturer: doc. dr. Ivan Jerman

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

doc. dr.

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

- vpis v tretji letnik študija,
- študent mora pred pristopom k izpitu pripraviti, predstaviti in oddati seminarsko nalogo.

Prerequisites:

Vsebina:

- Uvod v vakuumsko tehniko in tehnologijo.
- Fizikalne osnove vakuumskih procesov in tehnologij.
- Generiranje vakuuma in vakuumske črpalke.
- Meritve tlaka v vakuumskem področju in vakuumski merilniki.
- Vakuumski materiali, sestavni elementi in vakuumski sistemi.

Content (Syllabus outline):

- Vakuumska tehnika v inženirstvu površin in tankih plasti.
- Fizikalno-kemijske lastnosti reaktivnih plazem.
- Plazemske tehnologije za obdelavo površin materialov.
- Vakuumska optoelektronika - hladne emisije elektronov iz nanomaterialov.
- Vakuumska toplotna izolacija: kriogenika, vakuumski paneli, vakuumski sončni zbiralniki.
- Metode za karakterizacijo površin in tankih plasti.



Temeljni literatura in viri / Readings:

Briggs, D. M., Seah, P. (1990) *Practical surface analysis by Auger and X-ray photoelectron spectroscopy*. Chichester: Wiley.

Gašperič, J. (2002) *Nasveti za uporabnike vakuumske tehnike*. Ljubljana: Društvo za vakuumsko tehniko Slovenije.

Jousten, K. (2004) *Wutz Handbuch Vakuumtechnik: Theorie und Praxis*. Wiesbaden: Vieweg.

Lafferty, J. M. (1988) *Foundations of vacuum science and technique*. New York: John Wiley and Sons. Inc.

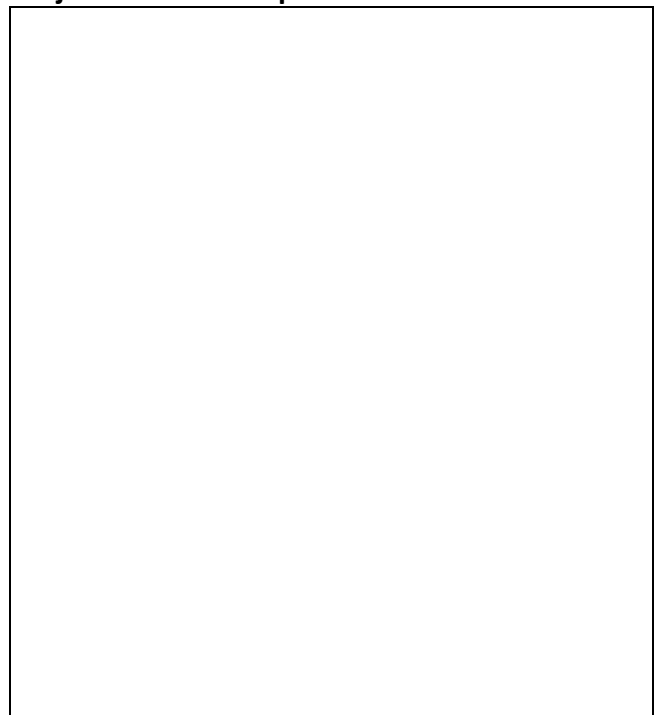
Nemanič, V. (2003) *Vakuumska znanost in tehnika*. Ljubljana: Društvo za vakuumsko tehniko Slovenije.

Cilji in kompetence:

Učna enota prispeva predvsem k razvoju naslednjih splošnih in specifičnih kompetenc:

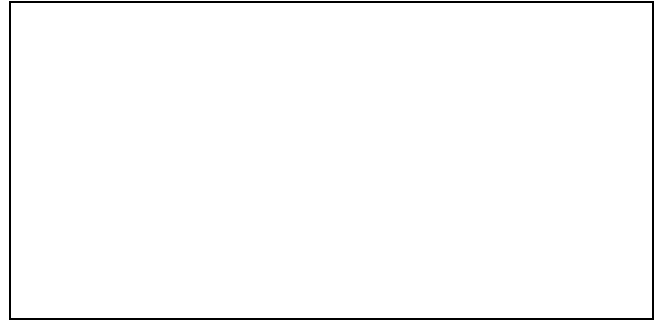
- sposobnost evidentiranja problema in njegove analize ter predvidevanja operativnih rešitev v tehnološkem smislu ali v procesu organizacije in vodenja,
- sposobnost obvladovanja standardnih razvojnih metod, postopkov in procesov,
- sposobnost uporabe pridobljenega teoretičnega znanja v praksi,
- sposobnost razumevanja in uporabe sodobnih teorij s področja tehniških, tehnoloških in naravoslovnih ved,
- sposobnost interdisciplinarnega povezovanja znanja,
- sposobnost reševanja konkretnih delovnih problemov na področju tehnologij in

Objectives and competences:



sistemov z uporabo standardnih metod in postopkov,

- poznavanje mehanskih in kemičnih lastnosti materialov, njihove uporabe in metod predelave,
- razvoj strokovnih veščin in spretnosti na področju tehnologij in sistemov.



Predvideni študijski rezultati:

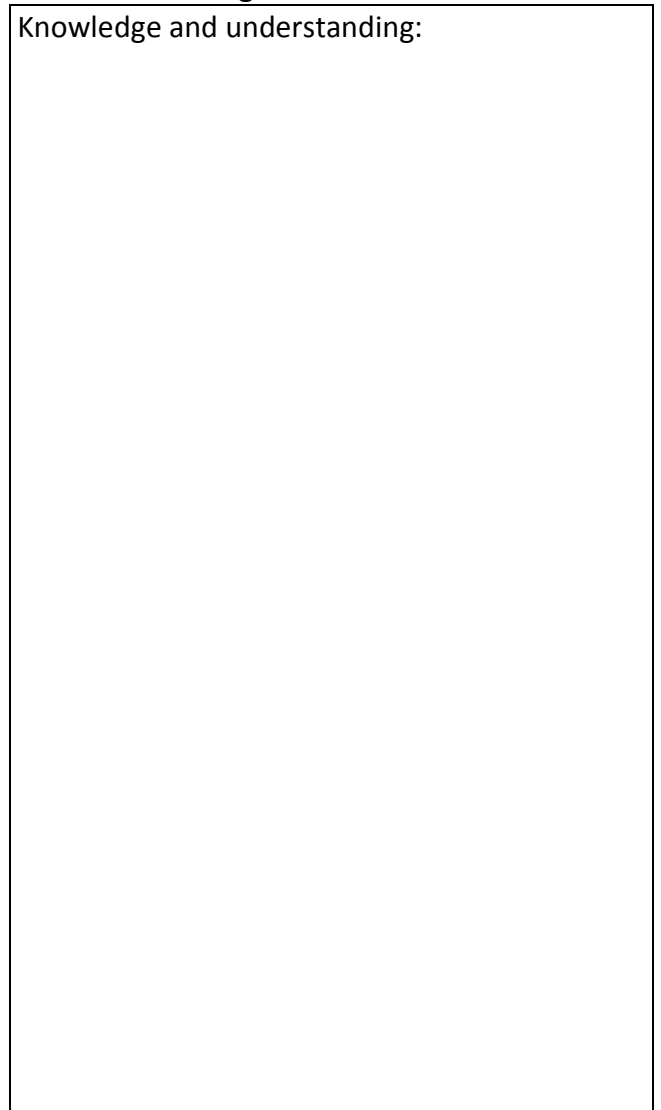
Znanje in razumevanje:

Študent/študentka:

- spozna fizikalne osnove vakuumske tehnike in tehnologije,
- spozna tehnike generiranja vakuuma in vakuumske črpalke,
- spozna vrste merilnikov za meritev tlaka v različnih vakuumskih področjih,
- seznanen se z vakuumskimi materiali in sestavnimi deli za izgradnjo vakuumskih sistemov,
- spozna vakuumske tehnologije, pomembne za inženirstvo površin in tankih plasti,
- spozna nove tehnologije, ki se uporabljajo za obdelavo površin s plazmo reaktivnih plinov,
- spozna področja vakuumske optoelektronike in hladno emisijo elektronov iz nanomaterialov,
- seznanen se z izbranimi metodami za karakterizacijo površin in tankih plasti, ki praviloma potekajo v ultravisokem vakuumu,
- se lažje odloča o izbiri ustreznih vakuumskih tehnologij in preiskovalnih metod pri razvoju novih ekološko neoporečnih izdelkov z veliko dodano vrednostjo.

Intended learning outcomes:

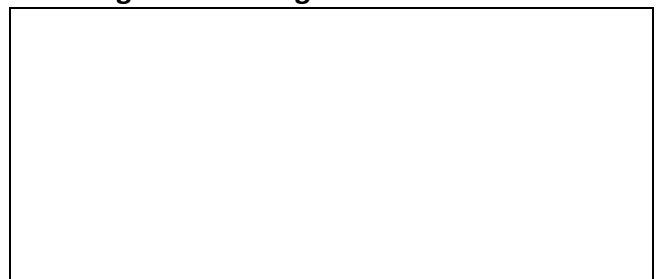
Knowledge and understanding:



Metode poučevanja in učenja:

- *predavanja* z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov),
- *vaje* v specializiranih laboratorijih Instituta Jožef Stefan, Odsek za tehnologijo površin in tankih plasti in po potrebi tudi v drugih odsekih IJS.

Learning and teaching methods:



- priprava *seminarskega dela* (izbira problematike, program dela, obravnava specifičnih vprašanj, dodatna razlaga).

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Delež (v %) /

Načini ocenjevanja:

Weight (in %) **Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):	Delež (v %) / Weight (in %)	Assessment: Type (examination, oral, coursework, project):
<ul style="list-style-type: none"> • ustni izpit • seminarsko delo Ocenjevalna lestvica: ECTS.	60% ocene 40% ocene	

Reference nosilca / Lecturer's references:

1. MOŠKON, Jože, PIVKO, Maja, JERMAN, Ivan, TCHERNYCHOVA, Elena, ZABUKOVEC LOGAR, Nataša, ZORKO, Milena, ŠELIH, Vid Simon, DOMINKO, Robert, GABERŠČEK, Miran. Cycling stability and degradation mechanism of LiMnPO [sub] 4 based electrodes. Journal of power sources, ISSN 0378-7753, Jan. 2016, vol. 303, str. 97-108.
<http://www.sciencedirect.com/science/article/pii/S037877531530481X/pdf?md5=d349e8102425afd7f07d48ca8c448e7a&pid=1-s2.0-S037877531530481X-main.pdf>, doi: 10.1016/j.jpowsour.2015.10.094. [COBISS.SI-ID 5816346]
2. ZORKO, Milena, VASILJEVIĆ, Jelena, TOMŠIČ, Brigita, SIMONČIČ, Barbara, GABERŠČEK, Miran, JERMAN, Ivan. Cotton fiber hot spot in situ growth of Stöber particles. Cellulose, ISSN 0969-0239, 2015, str. 1-11, ilustr. <http://link.springer.com/article/10.1007%2Fs10570-015-0762-4>, doi: 10.1007/s10570-015-0762-4. [COBISS.SI-ID 5767706]
3. VASILJEVIĆ, Jelena, JERMAN, Ivan, JAKŠA, Gregor, ALONGI, Jenny, MALUCELLI, Giulio, ZORKO, Milena, TOMŠIČ, Brigita, SIMONČIČ, Barbara. Functionalization of cellulose fibres with DOPO-polysilsesquioxane flame retardant nanocoating. Cellulose, ISSN 0969-0239, 2015, vol. 22, no. 3, str. 1893-1910. <http://link.springer.com/article/10.1007/s10570-015-0599-x>, doi: 10.1007/s10570-015-0599-x. [COBISS.SI-ID 3109744]
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6. VASILJEVIĆ, Jelena, TOMŠIČ, Brigita, JERMAN, Ivan, OREL, Boris, JAKŠA, Gregor, SIMONČIČ, Barbara. Novel multifunctional water- and oil- repellent, antibacterial, and flame-retardant cellulose fibres created by the sol-gel process. Cellulose, ISSN 0969-0239, 2014, vol. 21, no. 4, str. 2611-2623, ilustr. <http://link.springer.com/article/10.1007/s10570-014-0293-4/fulltext.html>, doi: 10.1007/s10570-014-0293-4. [COBISS.SI-ID 3007088]
7. PIRNAT, Klemen, BITENC, Jan, JERMAN, Ivan, DOMINKO, Robert, GENORIO, Boštjan. Redox-active functionalized graphene nanoribbons as electrode material for Li-ion batteries. ChemElectroChem, ISSN 2196-0216, Dec. 2014, vol. 1, iss. 12, str. 2131-2137.

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<http://www.sciencedirect.com/science/article/pii/S0927024813004327#>, doi: 10.1016/j.solmat.2013.08.025. [COBISS.SI-ID 5335578]

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