UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	PROCESI V INDUSTRIJSKI KEMIJI
Course Title:	PROCESSES IN INDUSTRIAL CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
VSŠP Kemijska tehnologija, 1. stopnja	/	2.	3.
PSP Chemical Technology, 1st Cycle	/	2nd	3rd

Vrsta predmeta / Course Type:	obvezni / Mandatory
Univerzitetna koda predmeta / University Course Code:	KT118

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	30	/	/	/	75	5

Nosilec predmeta / Lecturer:	doc. dr. Boštjan Genorio / dr. Boštjan Genorio, Assistant Professor prof. dr. Urška Šebenik / dr. Urška Šebenik, Full Professor
Jeziki / Languages:	**Predavanja / Lectures:** slovenski / Slovenian **Vaje / Tutorial:** /

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
Katalitski postopki: vloga in delovanje katalizatorja v tehnološkem procesu, homogena in heterogena k ataliza, aktivnost in druge lastnosti katalizatorja, kat alizatorski strupi in deaktivacija katalizatorjev. **Razklop mineralnih surovin:** Razklop mineralov, pre cipitacija in kristalizacija, prenasičenje, nukleacija in vpliv na lastnosti produktov kristalizacije, rast in zorenje kristalov. **Industrijski elektrokemijski procesi:** Osnove elektro kemijskih procesov, prenapetost, celični separatorji in druge značilnosti elektrokemijskih reaktorjev, industrijska elektroliza in galvanotehnika. **Visokotemperaturni procesi:** elektrotermični in drugi termični procesi, peči, metalurški procesi.	**Catalytic processes:** Role and function of catalyst in technological process ; Homogeneous and heterogeneous catalysis; A ctivity and other properties of the catalyst; Catalyst deactivation and catalyst poisons. **Decompositions of mineral raw materials:** Dec ompositions of minerals; Precipitation and cryst allization, supersaturation, nucleation and impacts on crystalline product properties; Grow th and aging of the crystals. **Industrial electrochemical processes:** Fundame ntals of electrochemical processes; Over voltage, current, and energy efficiency; Cell sep arators and other characteristics of electrochem ical reactors; industrial electrolysis and electropl

Tehnični plini: industrijski tehnični plini, osnove krio tehnike, proizvodnja, shranjevanje in distribucija pli nov. **Predelava fosilnih snovi:** katalitski in nekatalitski procesi, reakcijski mehanizmi, proizvodi in čiščenje proizvodov; kemikalije iz sinteznega plina; tehnologija reakcij v plinastem stanju. **Polimerizacijski procesi:** reakcijski mehanizmi; primeri tehnologij. **Optimizacija proizvodnih procesov:** Primer optimizirane proizvodnje sladkorja. **Kvantitativna obravnava enostavnih reakcijskih in separacijskih procesov:** totalna in komponentna integralna snovna bilanca za kontrolni volumen, totalna in komponentna diferencialna snovna bilanca za kontrolni volumen; računski primeri.	ating. **High temperature processes:** Electrothermal and other thermal processes; Furnaces; Metallurgical processes. **Industrial gases:** Industrial technical gases; prin ciples of cryogenics; Production, storage and dis tribution. **Processing of fossil raw materials:** Catalytic and noncatalytic processes; Reaction mechanisms; Products and their purification; Chemicals from the synthesis gas; Technology of reactions in a gaseous phase. **Polymerization processes:** Reaction mechanisms; Examples of polymer technology. **Optimization of production processes:** Sugar production example. **Quantitative description of simple reaction and separation processes:** Total and component integral material balance for control volume; Total and component differential material balance for control volume; problems.

Temeljna literatura in viri / Readings:

- J. A. Moulijn, M. Makkee, A. van Diepen, Chemical Process Technology, Wiley, Chicester, 2001, 420 str. (40 %).
- R. M. Felder, R. W. Rousseau, Elementary principles of chemical processes, 3. izdaja, John Wiley and Sons, New York, 2000, 606 str. (40 %)

Dopolnilna literatura:

- Austin: Shreeves Chemical Process Industries, 6. izdaja, Mc Graw-Hill, New York, 1995, 830 str. (20 %).

Cilji in kompetence:	**Objectives and Competences:**
Slušatelji se v okviru predavanj in seminarja seznanijo z različnimi nivoji in osnovnimi značilnostmi kemijske industrijske proizvodnje, z osnovami kemijskih industrijskih procesov ter njihovimi infrastrukturnimi pogoji, možnostmi za uspešno in varno vodenje procesov.	Students become familiar with: different levels and basic characteristics of industrial chemical production, fundamentals of chemical industrial processes and their infrastructure requirements, possibilities for successful and safe processes management.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študentje se naučijo analizirati industrijske procese. Spoznajo osnovne značilnosti industrijskih procesov in potrebne pogoje za sodobno industrijsko proizvodnjo.	<u>Knowledge and Comprehension</u> Students learn how to analyze industrial processes, about basic features of industrial processes and necessary conditions for modern industrial production.
<u>Uporaba</u> Pri analizi postavitve procesov, njihovega delovanja in problemov, ki se pojavljajo v industrijskih	<u>Application</u> In analyses of process setup, process operation, and problem solving in industrial processes.

procesih.	
Refleksija Razvija sposobnost ovrednotenja in analize kompleksnih sistemov kakršni so v kemijski in procesnih industrijah vendar lahko pridobljena znanja uporabi tudi širše.	Analysis Students develop the ability of evaluation and analysis of complex systems occurring in chemical and process industries. The acquired knowledge is widely applicable.
Prenosljive spretnosti Teoretične principe dodatno spoznava pri njihovi implementaciji v industrijsko merilo in prakso ter kritično vrednoti skladnost med teoretičnimi načeli in praktičnim ravnanjem.	Skill-transference Ability Students recognise theoretical principles in industrial scale implementations. They are able of critical evaluation and comparison between theoretical principles and practice.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja in seminar	Lectures and seminar

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni in ustni izpit. Možnost opravljanje pisnega izpita s kolokviji. Izpit je sestavljen iz ločenega preverjanja posameznih vsebin.		Written and oral exam. Written exam may be accomplished by written tests. The exam is consisted of partial assessments of the contents.

Reference nosilca / Lecturer's references:

- MOHORIČ, Ines, **ŠEBENIK, Urška**. Semibatch anionic ring-opening polymerization of octamethylcyclotetrasiloxane in emulsion. Polymer, ISSN 0032-3861. [Print ed.], 2011, vol. 52, no. 20, str. 4423-4428. [COBISS.SI-ID 35309317]

- **ŠEBENIK, Urška**, GOLOB, Janvit, KRAJNC, Matjaž. Comparison of properties of acrylic-polyurethane hybrid emulsions prepared by batch and semibatch processes with monomer emulsion feed. Polymer international, ISSN 0959-8103, 2003, vol. 52, no. 5, str. 740-748. [COBISS.SI-ID 24954117]

- RUČIGAJ, Aleš, ALIČ, Branko, KRAJNC, Matjaž, **ŠEBENIK, Urška**. Investigation of cure kinetics in a system with reactant evaporation : epoxidized soybean oil and maleic anhydride case study. European Polymer Journal, ISSN 0014-3057. [Print ed.], 2014, vol. 52, no. 1, str. 105-116. [COBISS.SI-ID 1667887]

- **Genorio B**, Strmcnik D, Subbaraman R, Tripkovic D, Karapetrov G, Stamenkovic V R, Pejovnik S and Marković N M 2010 Selective catalysts for the hydrogen oxidation and oxygen reduction reactions by patterning of platinum with calix [4] arene molecules Nat. Mater. 9 998–1003
- **Genorio B**, Lu W, Dimiev A M, Zhu Y, Raji A-R O, Novosel B, Alemany L B and Tour J M 2012 In Situ Intercalation Replacement and Selective Functionalization of Graphene Nanoribbon Stacks ACS Nano 6 4231–40
- Xiang C, Behabtu N, Liu Y, Chae H G, Young C C, **Genorio B**, Tsentalovich D E, Zhang C, Kosynkin D V, Lomeda J R, Hwang C-C, Kumar S, Pasquali M and Tour J M 2013 Graphene Nanoribbons as an Advanced Precursor for Making Carbon Fiber ACS Nano 7 1628–37
- Xiang C, Cox P J, Kukovecz A, **Genorio B**, Hashim D P, Yan Z, Peng Z, Hwang C-C, Ruan G, Samuel E L G, Sudeep P M, Konya Z, Vajtai R, Ajayan P M and Tour J M 2013 Functionalized Low Defect Graphene

Nanoribbons and Polyurethane Composite Film for Improved Gas Barrier and Mechanical Performances. ACS Nano 7 10380–6

- Raji A-R O, Varadhachary T, Nan K, Wang T, Lin J, Ji Y, **Genorio B**, Zhu Y, Kittrell C and Tour J M 2016 Composites of Graphene Nanoribbon Stacks and Epoxy for Joule Heating and Deicing of Surfaces ACS Appl. Mater. Interfaces 8 3551–6