UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	POLIMERNO REAKCIJSKO INŽENIRSTVO
Course Title:	POLYMER REACTION ENGINEERING

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Kemijsko inženirstvo, 2. stopnja	**/**	**1.**	**2.**
USP Chemical Engineering, 2nd Cycle	**/**	**1st**	**2nd**

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: IN2I06

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	**30**	**15 LV**	**/**	**/**	**75**	**5**

Nosilec predmeta / Lecturer: prof. dr. Urška Šebenik / Dr. Urška Šebenik, Full Professor

Jeziki / Languages:

Predavanja / Lectures:	**slovenski / Slovenian**
Vaje / Tutorial:	**slovenski / Slovenian**

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):
- Mehanizmi polimerizacij, vplivi reakcijskega medija - Homogena radikalska polimerizacija: kinetika radikalske polimerizacije, difuzijsko kontrolirane reakcije, vrste polimerizacijskih reaktorjev, kinetično modeliranje, modeliranje porazdelitev molekulskih mas, načrtovanje reaktorjev; - Heterogene polimerizacije: suspenzijska in emulzijska polimerizacija, kinetika heterogenih polimerizacijskih procesov, transportni pojavi, vrste reaktorjev, načrtovanje procesnih naprav; - Povečevanje polimerizacijskih procesov; - Seminar in laboratorijske vaje: Obravnava izbranih integralnih polimerizacijskih procesov.	- Polymerization mechanisms, effects of reaction medium - Homogeneous free-radical polymerization: polymerization kinetics, diffusion controlled reactions, types of polymerization reactors, kinetics modelling, molecular weight distribution modelling, reactor and equipment design; - Heterogeneous polymerizations: suspension polymerization, emulsion polymerization, kinetics of heterogeneous polymerization processes, transport phenomena, types of reactors, reactor and equipment design; - Scale-up for polymerization processes;

	- Seminar and laboratory practice: Selected case studies of integrated polymerization processes.

Temeljna literatura in viri / Readings:

- Rudin, The Elements of Polymer Science and Engineering, 2nd Edition, Academic Press, London, 1999, 483 pages, (50 %).
- J. M. Asua, Polymer reaction engineering, Blackwell Publishing LTD, Oxford, 356 str. (40 %).
- N. A. Dotson, R. Galvan, R. L. Laurence, M. Tirrell, Polymerization Process Modelling, VCH, New York, 1996, 359 pages, (20 %).

Dopolnilna literatura:

- R. G. Gilbert, Emulsion Polymerization: A Mechanistic Approach, Academic Press, London, 1995, 341 pages.
- T. Meyer in J. Keurentjes, Handbook of Polymer Reaction Engineering, Wiley-VCH, Weinheim, 2005, 1083 pages.

Cilji in kompetence:	**Objectives and Competences:**
Cilj predmeta je, da študentje osvojijo pomen in vlogo reakcijskega inženirstva na področju polimerizacijskih procesov. Študentje pri predmetu pridobijo naslednje specifične kompetence: - poznavanje reakcijske kinetike polikondenzacij in vpliva procesnih pogojev na kinetiko; - poznavanje reakcijske kinetike radikalske polimerizacije in vpliva procesnih pogojev na kinetiko; - poznavanje reakcijske kinetike polimerizacijskih procesov v heterogenih sistemih; - razumevanje vpliva transporta gibalne količine, snovi in toplote na sintezo polimerov; - razumevanje modeliranja polimerizacjiskih shem; - poznavanje kinetičnega modeliranja polimerizacijskih procesov; - razumevanje uporabe matematičnih modelov za načrtovanje procesnih naprav; - razumevanje povečevalnih kriterijev, specifičnih za posamezne polimerizacijske procese.	Understanding the importance and role of reaction engineering in polymerization processes; Acquisition of knowledge about step-growth polymerization kinetics and about the effect of process parameters on kinetics; Acquisition of knowledge about chain-growth polymerization kinetics and about the effect of process parameters on kinetics; Acquisition of knowledge about kinetics in heterogeneous polymerization systems; Understanding of effects of momentum, mass and heat transport on polymer synthesis; Understanding the principles of polymerization scheme modelling; Ability to model the kinetics of polymerization processes; Understanding the implementation of mathematical models in reactor and process equipment design; Understanding the scale-up criteria for specific polymerization processes.

Predvideni študijski rezultati:	Intended Learning Outcomes:
Znanje in razumevanje Študent zna samostojno analizirati polimerizacijski proces in ga kvantitativno zapisati. Zapisane modele zna uporabiti za analizo, načrtovanje in optimizacijo različnih polimerizacijskih procesov.	Knowledge and Comprehension Ability of independent polymerization process analysing and quantitative describing; Ability of employing theoretical mathematical models for analysis, design and optimization of polymerization processes.
Uporaba Pridobljena znanja je sposoben uporabiti pri samostojnem razvojnem in raziskovalnem delu na področjih analize, načrtovanja in optimizacije procesov.	Application Acquired knowledge is necessary for independent research and development in the area of process analysis, design and optimization.
Refleksija Študent je sposoben samostojno sklepati, definirati problem, postavljati zaključke in probleme reševati. Znanje polimernega reakcijskega inženirstva mu omogoča aktivno sodelovanje in komunikacijo s strokovnjaki drugih tehniških in naravoslovnih ved.	Analysis Development of abilities of autonomous deducting, problem defining, problem solving, and coming to conclusions; Ability to communicate and cooperate with experts from familiar and other engineering and natural sciences.
Prenosljive spretnosti Zna identificirati in reševati probleme, sposoben je zbiranja in interpretacije podatkov, kritične analize in sinteze pridobljenih znanj.	Skill-transference Ability Ability to identify and solve problems, to collect and interpret data, to analyse results critically and to synthesize knowledge.

Metode poučevanja in učenja:	Learning and Teaching Methods:
Predavanja, seminarji, vaje.	Lectures, seminars, laboratory practice.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Pisni izpit. Opravljene vaje in seminarska naloga so pogoj za pristop k izpitu.		Written exam. Laboratory practice and project work are prerequisites to exam attendance.

Reference nosilca / Lecturer's references:

- 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]
- MOHORIČ, Ines, **ŠEBENIK, Urška**. Semibatch anionic ring-opening polymerization of octamethylcyclotetrasiloxane in emulsions : effect of the amount of seed polymer particles. *Polymer international*, ISSN 0959-8103, 2013, vol. 62, no. 7, str. 1022-1028. [COBISS.SI-ID 36249093]
- **ŠEBENIK, Urška**, KRAJNC, Matjaž. Seeded semibatch emulsion copolymerization of methyl methacrylate and butyl acrylate using polyurethane dispersion : effect of soft segment length

on kinetics. *Colloids and surfaces. A, Physicochemical and Engineering Aspects*, ISSN 0927-7757. [Print ed.], 2004, vol. 233, no. 1/3, str. 51-62. [COBISS.SI-ID 25609989]