KATALIZA IN SODOBNA ORGANSKA KEMIJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Kataliza in sodobna organska kemija
Course title:	Catalysis and Modern Organic Chemistry
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Kemija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik, 2. letnik	zimski	izbirni

Univerzitetna koda predmeta/University course code:	0549174
Koda učne enote na članici/UL Member course code:	K2I23

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
15	15	45 LV			75	5

Nosilec predmeta/Lecturer:	prof. dr. Marjan Jereb
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional
Jeziki/Languages:	Predavanja/Lectures: Angleščina, Slovenščina Vaje/Tutorial: Angleščina, Slovenščina

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):
1. Temelji katalize (primerjava s klasično kemijo, bistvene razlike) 2. Uvod in pomen katalize v organski kemiji (prednosti katalitskih reakcij v primerjavi s stehiometrijskimi) 3. Pregled nekaterih katalitskih pretvorb: -oksidacije (uporaba manj nevarnih oksidantov) -redukcije (uporaba vodika in heterogenih katalizatorjev) -kislinsko in bazno katalizirane reakcije (različni zeoliti kot katalizatorji v kemiji) 4. Kataliza v neklasičnih medijih (kataliza faznega prenosa, v ionskih tekočinah, perfluoro topilih,...) 5. Netipična aktivacija reaktantov (mehanokemija in pretvorbe pri visokih tlakih)	1. Fundamentals of catalysis (comparison with classical chemistry, essential differences) 2. Introduction and meaning of catalysis in organic chemistry (advantages of catalytic reactions in comparison with stoichiometric reactions) 3. Survey of some of catalytic transformation: -oxidation (application of less hazardous oxidants) -reduction (use of hydrogen and heterogeneous catalysts) -acid- and base-catalyzed reactions (various zeolites as catalysts in chemistry) 4. Catalysis in non-classical media (phase-transfer catalysis, in ionic liquids, perfluorinated solvents,…) 5. Non-typical activation of reactants (mechanochemistry and transformations under high pressure)

6. Kemikalije iz obnovljivih virov (pregled nekaterih kemikalij iz obnovljivih virov)	6. Chemicals from renewable sources (survey of some chemicals from renewable sources)

Temeljna literatura in viri/Readings:

-I. Arends, R. Sheldon, U. Hanefeld: *Green Chemistry and Catalysis*, Wiley-VCH, Weinheim 2007 (250 pages)
-Eco-Friendly Synthesis of Fine Chemicals, Roberto Ballini, Ed. RSC, 2009 (selected topics)
-Inovations in Green Chemistry and Green Engineering, P. T. Anastas, J. B. Zimmerman, Eds., Springer, 2012
(selected topics)

Cilji in kompetence:	**Objectives and competences:**
-zavedanje globalnega problema onesnaženosti okolja in potencialnih rešitev, ki jih lahko ponudi kataliza -pomen katalitskih reakcij v primerjavi s stehiometrijskimi pretvorbami -poznavanje tipičnih oksidacij z uporabo manj nevarnih oksidantov in katalizatorjev -tipične okolju prijazne redukcije z vodikom in heterogenimi katalizatorji -poznavanje kislih in bazičnih zeolitov, ki se uporabljajo v katalizi -poznavanje katalize v alternativnih reakcijskih medijih kot npr. kataliza faznega prenosa, katalitske reakcije v ionskih tekočinah in v perfluoriranih topilh -poznavanje netipične aktivacije pri visokih tlakih in pri mehanokemijskih pogojih -poznavanje alternativnih, obnovljivih surovin in njihovih pretvorb za sintezo nekaterih pomembnih kemikalij	-awareness of the global issue of pollution of environment and potential solutions offered by catalysis -importance of catalytic reactions in comparison with stoichiometric transformations -knowledge of typical oxidations using less hazardous oxidants and catalysts -typical environmentally friendly reductions utilizing hydrogen and heterogeneous catalysts -knowledge of acidic and basic zeolites in catalysis -knowledge of catalysis in alternative reaction media such as e.g. phase transfer catalysis, catalytic reactions in ionic liquids and in perfluorinated solvents -knowledge of atypical activation at high pressures and under mechanochemical conditions -knowledge of alternative, renewable raw materials and their transformations in synthesis of some of important chemicals

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: -poznavanje alternativnih sinteznih procesov -poznavanje katalitskih pretvorb -sposobnost analize klasičnih pretvorb in razvoj nadgradnje v okolju bolj prijazen proces -znanje za načrtovanje novih, katalitskih, okolju bolj prijaznih transformacij -sposobnost vrednotenja relevantnosti posameznih alternativnih procesov	Knowledge and understanding: -knowledge of alternative synthetic processes -knowledge of catalytic transformations - ability to analyse classic transformations and develop upgrades in an environmentally friendly process -knowledge of designing of new, catalytic and environmentally friendly transformations -ability to evaluate the relevance of individual alternative processes

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanje, seminarji, laboratorijske vaje.	Lectures, seminars and practical laboratory work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit, ki ga lahko nadomesti ustni izpit.	50,00 %	Written exam that can be replaced by oral exam.
Opravljene laboratorijske vaje.	50,00 %	Accomplished practical laboratory work.

Reference nosilca/Lecturer's references:

-M. Jereb, M. Zupan, S. Stavber: Effective and selective iodofunctionalisation of organic molecules in water using the iodine-hydrogen peroxide tandem; *Chem. Commun.* 2004, 2614–2615.

-M. Jereb: Highly atom-economic, catalyst- and solvent-free oxidation of sulfides into sulfones using 30% aqueous H2O2; *Green Chem.*, 2012, *14*, 3047–3052.
-M. Jereb: Highly atom economical uncatalysed and I2-catalysed silylation of phenols, alcohols and carbohydrates, using HDMS under solvent-free reaction conditions (SFRC); *Tetrahedron* 2012, 68, 3861–3867.
-M. Jereb, D. Vražič: Iodine-catalyzed disproportionation of aryl-substituted ethers under solvent-free reaction conditions; *Org. Biomol. Chem*. 2013, *11*, 1978–1999.
-M. Jereb, L. Hribernik: Conversion of thiols into sulfonyl halogenides under aerobic and metal-free conditions; *Green Chem*. 2017, *19*, 2286-2295.