Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

Faculty of Chemical Technology and Engineering

Field of study	Chemical Engineering		
Mode of study	stationary	*Level*	first cycle
Graduate's qualification	inżynier		
Area(s) of study	nauki techniczne		
Educational profile	general academic		
Module			
Course unit	**Concepts in Modern Homogeneous and Heterogeneous Catalysis**		
Code	ChEn_1A_S_C19		
Field of specialisation			
Administering faculty	Institute of Inorganic Chemical Technology and Environmental Engineering		
ECTS	3,0	*ECTS (forms)*	3,0
Form of course credit	credits	*Language*	english
Electives		*Elective group*	

Form of instruction	*Code*	*Semester*	*Hours*	*ECTS*	*Weight*	*Credit*
lecture	W	6	30	1,5	0,50	credits
laboratory course	L	6	30	1,5	0,50	credits

Leading teacher	Moszyński Dariusz (Dariusz.Moszynski@zut.edu.pl)
Other teachers	Janus Ewa (Ewa.Janus@zut.edu.pl), Lewandowski Grzegorz (Grzegorz.Lewandowski@zut.edu.pl), Moszyński Dariusz (Dariusz.Moszynski@zut.edu.pl), Ossowicz Paula (Paula.Ossowicz@zut.edu.pl), Urbala Magdalena (Magdalena.Urbala@zut.edu.pl), Wróblewska Agnieszka (Agnieszka.Wroblewska@zut.edu.pl)

Prerequisites	
W-1	Inorganic Chemistry
W-2	Organic Chemistry
W-3	Physical Chemistry

Module/course unit objectives	
C-1	Student knows the composition and structure of moder homo- and heterogeneous catalysts
C-2	Student knows the contemporary experimental methods applied to evaluate the properties of catalysts
C-3	Student is able to select a proper catalyst in regard to the chemical reaction

Course content divided into various forms of instruction		*Number of hours*
T-W-1	Advanced Aspects of Mechanisms in Heterogeneous Catalysis	4
T-W-2	Modern Synthesis in Inorganic Reactions	4
T-W-3	Environmental Catalysis	4
T-W-4	Phase transfer catalysis – fundamentals and application in organic industrial processes	4
T-W-5	Strategies of Ionic liquids application in catalysis	3
T-W-6	Homogeneous transition metal complexes catalysis - aspects of fundamentals and application in organic synthesis	4
T-W-7	Zeolites and zeolite-like materials as the heterogeneous catalysts – structures, properties, synthesis and applications in organic synthesis	4
T-W-8	Activity Loss	3
T-L-1	Diels-Alder reaction in ionic liquid as medium in the presence and without metal catalysts	4
T-L-2	Alkylation process under phase transfer catalysis conditions	4
T-L-3	Homogeneous catalysis - The isomerisation of allyl ethers catalyzed by ruthenium complexes	4
T-L-4	Synthesis and characterization of Ti-MCM-41 catalyst	3
T-L-5	Cobalt molybdenum nitrides as a modern catalysts for ammonia synthesis	4
T-L-6	Surface reactions by electron spectroscopy	4
T-L-7	Photocatalysis on modified TiO2	4
T-L-8	Active removal of air polutions	3

Student workload - forms of activity		*Number of hours*
A-W-1	uczestnictwo w zajęciach	30

Student workload - forms of activity		*Number of hours*
A-W-2	praca z literaturą przedmiotu	15
A-L-1	uczestnictwo w zajęciach	30
A-L-2	opracowanie wyników badań	15

Teaching methods / tools	
M-1	wykład problemowy
M-2	metoda przypadków
M-3	ćwiczenia laboratoryjne

Evaluation methods (F - progressive, P - final)		
S-1	F	sprawdzian
S-2	F	egzamin

Designed learning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to the learning outcomes defined for the particular areas of education	Reference to learning outcomes leading to the degree of "inżynier"	Course objectives	Course content	Teaching methods	Evaluation methods
Knowledge							
ChEn_1A_C19_W01 Has a basic and advanced knowledge about homo- and heterogenous catalysis	ChEn_1A_W10 ChEn_1A_W12	P6S_WG_TA11		C-1	T-W-1	M-1 M-2 M-3	S-1
Skills							
ChEn_1A_C19_U01 Is able to choose, prepare and applicate the proper catalyst for a given chemical process.	ChEn_1A_U01 ChEn_1A_U03 ChEn_1A_U05 ChEn_1A_U08 ChEn_1A_U10 ChEn_1A_U16	P6S_UO P6S_UU P6S_UW_TA11 P6S_UW_TA13 P6S_UW_TA14	P6S_UW_IA11 P6S_UW_IA14	C-3	T-W-5	M-2 M-3	S-1
Other social / personal competences							
ChEn_1A_C19_K01 Is able to manage an analysis of catalytic process.	ChEn_1A_K01 ChEn_1A_K03 ChEn_1A_K04 ChEn_1A_K05	P6S_KK P6S_KO P6S_KR		C-3	T-W-3 T-W-5	M-1 M-2 M-3	S-1

Required reading

1. G. Ertl, H. Knozinger, F. Schuth, J. Weikamp, Handbook of Heterogeneous Catalysis, Wiley-VCH, Weinheim, 2008
2. A. Behr, P. Neubert, Applied Homogeneous Catalysis, Wiley-VCH, 2012
3. R.H. Crabtree, The organometallic chemistry of the transition metals, John Wiley&Sons, 2005
4. S. Bhaduri, D. Mukesh, Homogeneous calalysis. Mechanisms and Iindustrial Applications, John Wiley & Sons, 2000
5. Jiri Cejka, Avelino Corma, Stacey Zones, Zeolites and Catalysis: Synthesis, Reactions and Applications, WILEY-VCH, 2010
6. Santi Kulprathipanja, Zeolites in Industrial Separation and Catalysis, WILEY-VCH, 2010
7. Edited by P. Wasserscheid, T. Welton, Ionic Liquids in Synthesis t.1 and t.2, Wiley-VCH, Weiheim, 2008, 2
8. C.M. Starks, C.L. Liotta, M.E.Halpern, Phase-Transfer Catalysis, Chapmann & Hall, New York, 1994
9. Ed.: I.T. Horvath, Encyclopedia of Catalysis Vol. 5 (p. 511-564), Wiley-Interscience, Hoboken, NJ, 2003
10. Ed.: K. Maruoka, Asymmetric Phase-Transfer Catalysis, Wiley-VCH, Weinheim, Germany, 2008