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	**Kinetics and Catalysis of Chemical Reactions**		
Code	ChEn_1A_S_C07		
Field of specialisation			
Administering faculty	Institute of Inorganic Chemical Technology and Environmental Engineering		
ECTS	6,0	*ECTS (forms)*	6,0
Form of course credit	examination	*Language*	english
Electives		*Elective group*	

Form of instruction	*Code*	*Semester*	*Hours*	*ECTS*	*Weight*	*Credit*
lecture	W	3	30	2,5	0,40	examination
laboratory course	L	3	30	2,0	0,30	credits
project course	P	3	15	1,5	0,30	credits

Leading teacher	Wróbel Rafał (Rafal.Wrobel@zut.edu.pl)
Other teachers	Wróbel Rafał (Rafal.Wrobel@zut.edu.pl)

Prerequisites

W-1	Basic chemistry and advanced mathematics

Module/course unit objectives

C-1	Getting knowledge about chemical reactions, catalysis and related calculations

Course content divided into various forms of instruction		*Number of hours*
T-W-1	Definitions and Concepts - Rate of Reaction; Turnover Frequency; Selectivity; Elementary Step and Rate Determining Step (RDS); Reaction Rates in Reactors; Metal Dispersion; Metal-Support Interactions (MSI)	4
T-W-2	Catalyst Characterization	3
T-W-3	Acquisition and Evaluation of Reaction Rate Data - Types of Reactors; Heat and Mass Transfer Effects; Intraphase Gradients; Criteria to Verify the Absence of Mass and Heat Transfer Limitations	4
T-W-4	Adsorption and Desorption Processes - Adsorption Rate; Desorption Rate; Adsorption Equilibrium on Uniform Surfaces-Langmuir Isotherms; Adsorption Equilibrium on Nonuniform (Nonideal) Surfaces; Activated Adsorption	5
T-W-5	Kinetic Data Analysis - Transition-State Theory (TST) or Absolute Rate Theory; The Steady-State Approximation (SSA); Heats of Adsorption and Activation Barriers on; Use of a Rate Determining Step (RDS) and/or a Most Abundant Reaction Intermediate (MARI)	4
T-W-6	. Modeling Reactions on Uniform (Ideal) Surfaces - Reaction Models with a RDS – Unimolecular Surface Reactions; Reaction Models with a RDS – Bimolecular Surface Reactions; Reaction Models with a RDS – Reactions between an Adsorbed Species and a Gas-Phase Species; Reaction Models with no RDS; A Series of Irreversible Steps – General; Data Analysis with an Integral Reactor;	5
T-W-7	Modeling Reactions on Nonuniform (Nonideal) Surfaces - Initial Models of a Nonuniform Surface; Correlations in Kinetics; Formalism of a Temkin Surface; Consequences of Temkin's Model;	3
T-W-8	Kinetics of Enzyme-Catalyzed Reactions	2
T-L-1	Kinetics of the ethyl acetate hydrolysis reaction	5
T-L-2	Simplex method in reaction kinetic	5
T-L-3	Impact of poisoning of catalyst on reaction kinetic.	5
T-L-4	Catalytic carbon monoxide oxidation	5
T-L-5	Catalytic ammonia decomposition	5
T-L-6	Catalytic high-pressure ammonia synthesis	5
T-P-1	Project of the real catalytic processes (individual project)	15

Student workload - forms of activity		*Number of hours*
A-W-1	Obligatory attendance the lactures	30

Student workload - forms of activity		*Number of hours*
A-W-2	Reading the literature	30
A-W-3	Homeworks	15
A-L-1	participation laboratory classes	30
A-L-2	Preparation of raports	30
A-P-1	preparation of the project	15
A-P-2	Studing the literature	30

Teaching methods / tools	
M-1	Lecture

Evaluation methods (F - progressive, P - final)		
S-1	P	Written exam

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_C07_W01 Student knows the theorem of catalysis and its applications in chemical engineering. He or she also knows typical catalytic chemical industrial processes.	ChEn_1A_W10 ChEn_1A_W20	P6S_WG_TA11		C-1	T-W-1 T-W-3 T-W-2 T-W-4	M-1	S-1
Skills							
ChEn_1A_C07_U01 Student is able to find literature data required for evaluation of catalytic processes with modern data bases and search engines. He or she is also able to plan experiments with catalytic reaction and choose the appropriate control techniques.	ChEn_1A_U01 ChEn_1A_U03 ChEn_1A_U05 ChEn_1A_U07 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-1	T-W-5 T-W-7 T-W-6	M-1	S-1
Other social / personal competences							
ChEn_1A_C07_K01 Student is able to teamwork focused on solving catalytically problems. He or she is understand the requirement of self-development in mastering the skills of catalytical processes in chemical engineering.	ChEn_1A_K01 ChEn_1A_K03 ChEn_1A_K04 ChEn_1A_K05	P6S_KK P6S_KO P6S_KR		C-1	T-L-2	M-1	S-1

Required reading
1. M. Albert Vannice, Kinetics of Catalytic Reactions, Springer, 2005