

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	Chemistry		
Code	ChEn_1A_S_B03		
Field of specialisation			
Administering faculty	Department of Inorganic and Analytical Chemistry		
ECTS	12,0	ECTS (forms)	12,0
Form of course credit	examination	Language	english
Electives		Elective group	



Form of instruction	Code	Semester	Hours	ECTS	Weight	Credit
lecture	W	2	30	5,0	0,40	examination
lecturing course	A	2	30	3,0	0,30	credits
laboratory course	L	2	60	4,0	0,30	credits

Leading teacher	Rozwadowski Zbigniew (Zbigniew.Rozwadowski@zut.edu.pl)					
Other teachers	El Fray Mirosława (Mirosława.ElFray@zut.edu.pl), Grzechulska-Damszel Joanna (Joanna.Grzechulska@zut.edu.pl), Kołodziej Beata (Beata.Kolodziej@zut.edu.pl), Nowicka-Scheibe Joanna (Joanna.Nowicka-Scheibe@zut.edu.pl), Rozwadowski Zbigniew (Zbigniew.Rozwadowski@zut.edu.pl), Sośnicki Jacek (Jacek.Sosnicki@zut.edu.pl), Wróblewska Elwira (Elwira.Wroblewska@zut.edu.pl)					

Prerequisites	
W-1	The basic knowledge of fundamental and inorganic chemistry as well as basic safety rules

Module/course unit objectives	
C-1	Knowledge and understanding the basic concepts and laws of inorganic and organic chemistry: type of chemical bonds, chemical reactions, classification and characterisation of inorganic and organic compounds as well as their structure.
C-2	Knowledge of relationships between physico-chemical properties of the various classes of compounds and their structure

Course content divided into various forms of instruction		Number of hours
T-W-1	Inorganic nomenclature. Reaction types. Reactions in solutions.	3
T-W-2	Solid state structure and the properties of solid substances. Coordination compounds. Electrochemistry.	3
T-W-3	Chemical kinetics (e.g.chemical equilibrium, equilibrium constant, reversible reactions)	3
T-W-4	Description of the organic molecular structure (functional groups, isomerism, chirality, conformers, etc.). Type of reactions (substitution, elimination, addition, radical reaction). Reaction mechanisms.	6
T-W-5	Organic reactions of various type of compounds (e.g. arenes, alcohols, aromatics, amines, carbohydrates). Stereochemistry	6
T-W-6	Types of polymers and polymerizations, polymers nomenclature.Molecular weight of polymers. Mechanisms of polymerization. Stereochemistry of polymers. Physical state of polymers and their properties	2
T-W-7	Basics of analytical chemistry. Analytical methods (accuracy, selectivity, sensitivity, experimental errors, statistical analysis of data).	2
T-W-8	Titrametric methods (acid-base, complexation, redox, precipitation). Gravimetric methods.	2
T-W-9	Overview of instrumental methods (UV-Vis, IR, NMR, GC, MS, etc.).	3
T-A-1	Hybrid orbitals and molecular structure.	2
T-A-2	Heterogeneous equilibria	2
T-A-3	Buffers: The control of pH	2
T-A-4	Acid – base equilibria in salt solutions	4
T-A-5	Equilibria in aqueous solutions of precipitates	4
T-A-6	Organic nomenclature, recognition and classification of organic compounds and their structure	4
T-A-7	Organic reaction equations and reaction mechanisms	4
T-A-8	Funcional group transformations. Project of synthetic paths	4

Course content divided into various forms of instruction		Number of hours
T-A-9	Kinetic of polymerization. Crosslink density calculations in polymer gels and networks. Polymer crystallinity and phase transitions. Polymer modulus and toughness. Miscibility of polymer blends	4
T-L-1	Occupational health and safety in the laboratory. Calibration of volumetric glassware: calibration of a buret. Acid-base titrimetry. Titration of HCl solution.	5
T-L-2	Reduction-Oxidation Titrations. Complexometric methods. Determination of total hardness of water	5
T-L-3	Qualitative analysis of cations of groups I, II and III	10
T-L-4	Qualitative analysis of cations of groups IV and V	5
T-L-5	Qualitative analysis of anions and salts	5
T-L-6	Safety rules and basic techniques of preparative chemistry (distillation, crystallization, extraction)	5
T-L-7	Preparation and purification of simple organic molecules (aspirin, acetanilide, p-bromoacetanilide)	10
T-L-8	Structure and purity determination of obtained compounds by selected spectroscopic methods	5
T-L-9	UV-Vis spectroscopy	5
T-L-10	Melt polycondensation of poly(ethylene terephthalate)(PET)	5

Student workload - forms of activity		Number of hours
A-W-1	Participation in lectures	30
A-W-2	Preparation for exam	60
A-W-3	Individual literary studies	60
A-A-1	Participation in classes	30
A-A-2	Preparation for classes	30
A-A-3	Individual solving tasks	30
A-L-1	Participation in classes (labs)	60
A-L-2	Preparation for practical classes	30
A-L-3	Development of results	15
A-L-4	Writing of class reports	15

Teaching methods / tools	
M-1	Lecture
M-2	Discussion
M-3	Labs

Evaluation methods (F - progressive, P - final)		
S-1	P	Written exam (lecture)
S-2	P	Continuous assessment: lab reports and activity (labs)

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
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Knowledge							
ChEn_1A_B03_W01 Students has knowledge and understanding of basic concepts and laws of chemistry: type of reactions, characterisation of organic and inorganic compounds, kinetics, chemical equilibrium, analytical methods.	ChEn_1A_W03 ChEn_1A_W10	P6S_WG_TA11		C-1 C-2	T-A-1 T-W-1 T-A-2 T-W-2 T-A-3 T-W-3 T-A-4 T-W-4 T-A-5 T-W-5 T-A-6 T-W-6 T-A-7 T-W-7 T-A-8 T-W-8 T-A-9 T-W-9	M-1 M-2 M-3	S-1

Skills							
ChEn_1A_B03_U01 Students are able to plan and conduct experiments, measurements or computer simulations, as well as to interpret the obtained results and draw conclusions	ChEn_1A_U01 ChEn_1A_U05 ChEn_1A_U08 ChEn_1A_U16	P6S_UO P6S_UU P6S_UW_TA11 P6S_UW_TA14	P6S_UW_IA11 P6S_UW_IA14	C-2	T-L-1 T-L-6 T-L-2 T-L-7 T-L-3 T-L-10 T-L-4	M-1 M-2 M-3	S-2

Other social / personal competences							
ChEn_1A_B03_K01 Students are able to cooperate and work in a group also as a team leader and have understanding the need of learning	ChEn_1A_K01 ChEn_1A_K03 ChEn_1A_K04 ChEn_1A_K05	P6S_KK P6S_KO P6S_KR		C-1	T-L-1 T-L-6 T-L-2 T-L-7 T-L-3 T-L-9 T-L-4 T-L-10 T-L-5	M-2 M-3	S-2

Required reading	
1. Harvey D., Modern analytical chemistry, McGraw-Hill Companies Inc., 2000, open access	
2. Curreli, G., Analytical instrumentation, Wiley, Chichester, 2000	
3. C. E. Housecroft and A. G. Sharpe, Inorganic Chemistry, Pearson Education Limited, Edinburgh, UK, 2001, ISBN 0582-31080-6	
4. P. W. Atkins, M. J. Clugston, M. J. Frazer, R. A. Y. Jones, Chemistry. Principles and applications, Longman Group UK Limited, New York, 1990, ISBN 0582-35590-7	
5. J. E. Brady, General Chemistry. Principles and Structure, John Wiley & Sons, New York, 1990, ISBN 0-471-62131-5	
6. W. W. Porterfield, Inorganic Chemistry. A Unified Approach, Academic Press Inc., London, 1993, ISBN 0-12-562981-8	
7. F.J. Davis, Polymer Chemistry, Exford University Press, New York, 2004	

<i>Required reading</i>
7. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, Pearson Education Inc., New Jersey, 2004, ISBN 0-13-120198-0
8. G. Odian, Principles of Polymerization, John Wiley&Sons, Inc., Hoboken, NJ, 2004
9. G. C. Hill, J. S. Holman, Chemistry in Context, Thomson Nelson and Sons Ltd, Edinburgh, UK, 1989, ISBN 0-17-438401-7
11. John E. McMurry, Organic Chemistry, New York, 2012, (8th Edition)
12. G. Marc Laudon, Organic Chemistry, Oxford, New York, 2002, (4th edition)