

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish **CHEMIA**
 Name in English **CHEMISTRY**
 Main field of study (if applicable): **POWER ENGINEERING**
 Specialization (if applicable):
 Level and form of studies: **1st level, part-time**
 Kind of subject: **obligatory**
 Subject code **ENN210002**
 Group of courses **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	18				
Number of hours of total student workload (CNPS)	90				
Form of crediting	crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1,5				

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of chemistry on secondary school level
2. Knowledge of elementary mathematics

SUBJECT OBJECTIVES

C1 Providing the knowledge about fundamental and applied chemical sciences and the target of their study, definitions, terms and symbols

C2 Providing the knowledge about structure and transformations of matter; providing the knowledge concerning the historical and modern atom structure model

C3 Providing the knowledge about the fundamentals of nuclear chemistry and its significance for power engineering

C4 Acquiring the knowledge concerning the periodic table of elements and its relation with atomic structure and element properties; providing the knowledge about classification, nomenclature and properties of inorganic compounds

C5 Acquiring the knowledge concerning solutions; dissolution process, chemical concentration representations; acquiring the skills to perform basic chemical calculations

C6 Acquiring the knowledge in the field of chemical reactions and their mechanisms, thermodynamics, kinetics and chemical equilibrium; acquiring the skills to perform stoichiometric calculations

C7 Acquiring the knowledge concerning the catalysis and catalysts, their mechanism of action and practical applications.

C8 Acquiring the knowledge in the field of electrochemistry, electrochemical reactions, batteries, galvanic cells, fuel cells, electrolysis process as well as corrosion mechanisms

C9 Providing the knowledge about fundamentals of organic chemistry, organic compound types; acquiring the knowledge concerning the properties of crude oil and its processing as well as properties of hydrocarbon fuels

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – knows fundamental and applied chemical sciences, definitions and chemical laws

PEK_W02 – knows fundamentals of structure of matter at molecular level, atomic and molecular interaction types, types of chemical bonds; understands the relation between molecular structure of matter and its macroscopic properties; knows historical and modern atom structure models

PEK_W03 – has elementary knowledge about nuclear chemistry, types of nuclear reactions, radiation, as well as the significance of nuclear chemistry in power engineering

PEK_W04 – has knowledge about the periodic table of elements, physical and chemical properties of elements; knows basic properties of oxides, hydroxides, acids and salts

PEK_W05 – has fundamental knowledge about various solution types, their properties, dissolution process, hydrolysis, dissociation, concentration representations; is able to perform basic calculations

PEK_W06 – knows the term of chemical reaction, has fundamental knowledge about reaction types and mechanisms, knows the basics of chemical kinetics and equilibrium, is able to perform stoichiometric calculations

PEK_W07 – knows fundamentals of catalysis, the principle of action of a catalyst and the aim of its practical application

PEK_W08 – has fundamental knowledge in the field of electrochemistry, knows the principles of operation of batteries, galvanic cells and fuel cells; knows the basics of electrochemical corrosion mechanisms

PEK_W09 – knows major types of organic compounds; has fundamental knowledge about the properties and processing of crude oil, knows the types and properties of hydrocarbon

fuels		
PROGRAMME CONTENT		
Form of classes - lecture		Number of hours
Lec1	Chemistry as a science and its significance for power engineering, fundamental and applied chemical sciences. Basic terms: atom, element, nuclide, isotope, atomic number, mass number. Mol as a unit of quantity, molar mass, Avogadro number. Simple and complex substances. Matter transformations: chemical reaction and physical phenomenon.	2
Lec2	Historical and modern atom structure models. Wave-like behavior of matter: wave – particle duality. Fundamentals of nuclear chemistry, radioactivity, nuclear reactions, half-life, decay chains. Nuclear energy, uranium fission, thermonuclear fusion.	2
Lec3	Periodic table of elements – historical and modern version. Periodicity of element properties; classification of elements as metals, metalloids and nonmetals. Electron configurations of atoms and ions. Classification of chemical compounds as organic and inorganic. Inorganic compounds – nomenclature, properties, preparation, reactions. Examples of applications.	2
Lec4	Solutions and mixtures. Types and properties of solutions. The definition of an electrolyte, dissociation, dissociation degree, dissociation constant. Ionic product of water, pH. Dissolution process, its mechanism, thermodynamics and practical applications. The definition of concentration. Various representations of concentration. Basic calculations concerning solutions.	2
Lec5	The definition of chemical bond, types of chemical bonds. Chemical reaction, substrates, products, reagents, chemical reaction equation. Classification of chemical reactions. Thermodynamics and mechanism of a chemical reaction, energy effect, activation energy. Hess's law. Basic stoichiometric calculations, mass conservation law, law of definite proportions.	1
Lec6	Chemical equilibrium and reaction kinetics. Reversible reactions and equilibrium state. Law of mass action. Le Chatelier's principle. The definition of reaction rate, extent of reaction, factors affecting the reaction rate and equilibrium state. Kinetic theories. Multi-stage reactions, reaction order.	1
Lec7	Catalysis. The term of catalyst, homogeneous and heterogeneous catalysts, properties of catalyst, activity, selectivity, Sabatier's principle. Mechanism of catalyzed reaction, interactions between the reagents and surface, adsorption, desorption, diffusion. Kinetic and diffusion area. Practical applications of catalysts and their significance in power engineering.	2

Lec8	Electrochemistry. Redox reactions. The term of oxidation state. Galvanic series. Standard potential. Galvanic cells of different types, electromotive force. Batteries and rechargeable batteries. Fuel cells. Electrolysis. Electrochemical corrosion, concentration cell, cathodic protection.	2
Lec9	Fundamentals of organic chemistry – types of organic compounds, properties, selected reactions. Classification and nomenclature of hydrocarbons. Crude oil, its origin, properties and processing. Selected refinery processes. Hydrocarbon fuels and their properties.	2
Lec10	Final test	2
	Total hours	18
TEACHING TOOLS USED		
N1. Lecture with multimedia presentation		
N2. Consultation hours		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
C (lecture)	PEK_W01 – PEK_W09	Crediting with grade
PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE:</u> [1] A. Bielański, Podstawy chemii nieorganicznej, PWN, Warszawa, 2003 [2] L. Jones, P. Atkins, Chemia ogólna, Wydawnictwo PWN [3] Steven S. Zumdahl, Susan A. Zumdahl, Chemistry, Wydanie 8 [4] P. Mastalerz, Elementarna Chemia Nieorganiczna, Wydaw. Chem. 1997 <u>SECONDARY LITERATURE:</u> [1] M.J. Sienko, R. A. Plane, Chemia - podstawy i zastosowania, WNT, W-wa, 2002 [2] Peter William Atkins, Physical Chemistry [3] J. Surygała (red.), Ropa naftowa: właściwości, przetwarzanie, produkty, WNT, Warszawa 2006 [4] E. Grzywa, J. Molenda, Technologia podstawowych syntez organicznych, WNT, Warszawa 1987		
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)		
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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
CHEMISTRY
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
POWER ENGINEERING**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Programme content***	Teaching tool number***
PEK_W01	K1ENG_W04	C1	Lec1	N1, N2
PEK_W02		C2	Lec2	
PEK_W03		C3	Lec2	
PEK_W04		C4	Lec3	
PEK_W05		C5	Lec4	
PEK_K06		C6	Lec5, Lec6	
PEK_W07		C7	Lec7	
PEK_W08		C8	Lec8	
PEK_W09		C9	Lec9	

** - enter symbols for main-field-of-study/specialization educational effects

*** - from table above