



Subject card

Subject name and code	Materials Science, PG_00047738						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2022		Academic year of realisation of subject		2022/2023		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Ewa Wagner-Wysiecka				
	Teachers		dr hab. inż. Ewa Wagner-Wysiecka dr hab. inż. Andrzej Nowak				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		5.0		90.0	125
Subject objectives	Understanding the basics of materials. Ability to select specific characteristics of the material intended for the construction and application particularly to solve general problems of therapeutics.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W53] Knows and understands, to an advanced extent, selected aspects of materials science and biomaterials constituting general knowledge related to the field of study		- student understands the criteria for selecting materials for a specific purpose - student understands the basic issues related to the receipt of materials for medical purposes, including industrial processes subject to a specific control - student knows the basic sources of information about modern materials and can reach them		[SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_U52] can determine properties of materials and biomaterials used in biomedical engineering		- student understands the definition of biocompatibility of materials - student has a basic knowledge about materials and their properties (mechanical, optical, magnetic) - student knows the relationship between the composition of specific materials and their properties - student is aware of the possibility of using materials with specific properties in medicine		[SU2] Assessment of ability to analyse information		

Subject contents	Solid state, physical and practical definitions, solid state structure. Chemical constitution and structure. Elements of crystallography, crystal lattice, monocrystals, polycrystals. Elements of symmetry. Crystallographic systems. Polymorphism, isomorphism, allotropic forms of elements, diamond, graphite, fullerenes, carbon nanotubes, isotropy, anisotropy. Metals, alloys, addition solid solutions, sinters. Inorganic coating on metals, corrosion. Ceramic materials. Amorphous materials, glass, application. Natural and synthetic fibres, organic and inorganic. Layers, methods of generation, monomolecular layers. Lipophilization and hydrophilic properties, wettability, lipo- and hydrophilic groups. Systems of dispersion, emulsions, role of detergents. Colloids, types, generation and biological role. Osmosis, electroosmosis, deionization of colloids, coagulation. Colloid dyes in medicine. Monomers, organic polymers, methods of production. Types of polymerization reactions, isomerism, space polymers. Condensation and addition polymers, biocompatibility. Chemical modification of polymers, ion exchangers. Reinforced materials, introduction to composite materials. Copolymers. Relation between the structure and properties of plastics. Examples of application of polymers in medicine: valves, artificial heart and kidney. Examples of application of metals and ceramics in medicine. Mechanical, thermal, optical, magnetic, biological properties of materials. Industrial methods of producing materials. Control of manufacturing process. Industrial synthesis of pharmaceutical products. Form of drugs, production and quality control. Therapy systems. Application of materials in biomedical engineering.		
Prerequisites and co-requisites	Matters realized during the subject "Chemistry", "Physics", "Mathematics".		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	51.0%	100.0%
Recommended reading	Basic literature	1. Każda encyklopedia materiałoznawstwa. 2. Podstawy dyfrakcji promieni rentgenowskich, B.D. Cullity, PWN, Warszawa 1964. 3. Materiały ceramiczne, R. Pampuch, PWN Warszawa 1988. 4. Farmacja stosowana, S. Janicki, A. Fiebig, M. Sznitowska, Warszawa PZWL 2006. 5. Chemia, L. Pauling, P. Pauling, PWN Warszawa 1997. Z. Florjańczyk, S. Pęczek (red.), Chemia polimerów tom I, II i III, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2001.	
	Supplementary literature	1. Biocybernetyka i inżynieria biomedyczna 2000. Tom 3. Sztuczne narządy, pod red. M. Nałęcza. 2. Wpływ obróbki termicznej i hydrolizy enzymatycznej na alergenicność białek http://www.pttz.org/zyw/wyd/czs/2007,%203(52)/15_Szymkiewicz.pdf	
	eResources addresses	Adresy na platformie eNauczanie: Materiałoznawstwo - kierunek Inżynieria Biomedyczna 2022/2023 - Moodle ID: 28964 https://enauzanie.pg.edu.pl/moodle/course/view.php?id=28964	
Example issues/ example questions/ tasks being completed	Give examples of substances crystallizing in the regular system. Replace the characteristics of quasicrystals. Minerals calcite and aragonite have the formula CaCO3 . Are these allotropic polymorphs? List the main materials used to produce the implants. Enter the properties and structure of the main biocompatible plastics. General characteristics of pharmaceutical substances. Basic therapeutic systems.		
Work placement	Not applicable		

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