GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Materials Science, PG_00047738		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
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 dr hab. inż. Lidia Jasińska-Walc	

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_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
[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

<table>
<tr><td>Subject contents</td><td>Solid state, physical and practical definitions, solid state structure. Chemical constitution and structure. Elements of crystalography, crystal lattice, monocrystals, polycrystals. Elements of symmetry. Crystallographic systems. Polymorphism, isomorphism, alotropic 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, coagullation. Coolloid 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 materiale. Control of manufacturing process. Industrial synthesis of pharmaceutical products. Form of drugs, production and quality control. Therapy systems. Application of materials in biomedical engineering.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Matters realized during the subject "Chemistry", "Physics", "Mathematics".</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam</td><td>51.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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.</td></tr>
<tr><td>Supplementary literature</td><td>1. Biocybernetyka i inżynieria biomedyczna 2000. Tom 3. Sztuczne narządy, pod red. M. Nałęcza. 2. Wpływ obróbki termicznej i hydrolizy enzymatycznej na alergenność białek http://www.pttz.org/zyw/wyd/czs/2007,%203(52)/15_Szymkiewicz.pdf</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Materiałoznawstwo 2023/2024 - Moodle ID: 37076
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=37076</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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