



Subject card

Subject name and code	Conductive organic materials, PG_00049384						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject				2026/2027	
Education level	first-cycle studies	Subject group				Optional subject group Subject group related to scientific research in the field of study	
Mode of study	Full-time studies	Mode of delivery				at the university	
Year of study	4	Language of instruction				Polish	
Semester of study	7	ECTS credits				4.0	
Learning profile	general academic profile	Assessment form				exam	
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Anna Lisowska-Oleksiak					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	15.0	0.0	45
	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	45		4.0		51.0	100
Subject objectives	The aim of the course is to acquaint students with the properties and possible applications of organic electric conductors, both macromolecular and low molecular mass.						
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	Understands, at an advanced level, selected aspects of the use of macromolecular organic and inorganic conducting compounds in biomedical applications			[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
	[K6_U52] can determine properties of materials and biomaterials used in biomedical engineering	Student is able to apply appropriate tools and methods to determine properties of organic and inorganic conductive materials."			[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		

Subject contents	<p>Course content – lecture</p> <p>Introduction to electrochemistry solid electrolytes (E) fixed electrical properties of ionic conductors of electricity. Polymer solid electrolytes. Electrolytes gel, hydrogels and gel electrolytes with aprotic solvents. Polyelectrolytes, ionomers, ion-selective membrane. Hydrogels and gel electrolytes with aprotic solvents. Polyelectrolytes, ionomers, ion-selective membrane (Nafion, others). Phase boundary electrode metal-electrolyte interface, boundary of the semiconductor / electrolyte. Electrode materials (MA) electroactive polymers case called Synthetic Metals like polyaniline, polypyrrole, polythiophene. Methods of preparing, electrical properties.</p> <p>The mechanism of charge transport in ion-electron conductors with transition metal atoms in the structure of molecular luminescent layer. Applications of organic light-emitting devices.</p> <p>Carbon materials with graphene planes; nanomaterials.</p> <p>B) Laboratory</p> <p>I) Synthesis and properties of the polymer "synthetic metal "(polypyrrole, polythiophene). - Manual.pdf</p> <p>II) Determination of the capacity of the electric charge of the material by means of impedance spectroscopy. Manual.pdf</p> <p>IV) Electrochromic properties of polyaniline. Examination of the polymer layer which changes color under the influence of an electric field. The use of potentiostat. Manual pdf</p> <p>V) Low molecular electroluminescent layer. Preparation method (dip coating) and spin coating) manual pdf</p> <p>VI) construction of modified enzyme electrodes containing redox centers of transition metal atoms (such as glucose oxidase) to the cell glucose</p> <p>C) PROJECT GROUP Topics exemplary academic year 2014/20145</p> <ul style="list-style-type: none"> - Electrochemical capacitor with electrodes a) polymeric b) carbon - Project of electrochromic devices - Glucose sensor based on ion selective membrane - Ethanol sensor based on amperometric measurements 														
Prerequisites and co-requisites	<p>Chemistry:</p> <p>General aspects :</p> <p>Structure of matter, chemical bonds, chemical compounds.</p> <p>The issue detailed:</p> <p>Physical chemistry, thermodynamic equilibrium, kinetics. Basic knowledge about synthesis of macromolecules.</p> <p>Chemistry of complex compounds, supramolecular chemistry.</p>														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="448 1789 794 1823">Subject passing criteria</th> <th data-bbox="794 1789 1141 1823">Passing threshold</th> <th data-bbox="1141 1789 1487 1823">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1823 794 1883">laboratory reports and tests - quality</td> <td data-bbox="794 1823 1141 1883">100.0%</td> <td data-bbox="1141 1823 1487 1883">20.0%</td> </tr> <tr> <td data-bbox="448 1883 794 1966">quality of project and quality of the presentation given on group meetings</td> <td data-bbox="794 1883 1141 1966">100.0%</td> <td data-bbox="1141 1883 1487 1966">20.0%</td> </tr> <tr> <td data-bbox="448 1966 794 2000">exam: oral or written</td> <td data-bbox="794 1966 1141 2000">50.0%</td> <td data-bbox="1141 1966 1487 2000">60.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	laboratory reports and tests - quality	100.0%	20.0%	quality of project and quality of the presentation given on group meetings	100.0%	20.0%	exam: oral or written	50.0%	60.0%
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Recommended reading	Basic literature	<p>1. Lecture course (ppt files)</p> <p>2. Laboratory manuals (pdf files)</p> <p>3. Franky So, Organic Electronics, CRC Press 2010</p> <p>4.R.W Kelsall, I.W. Hamley, M. Geoghegan , Nanoscience and nanotechnology</p>
	Supplementary literature	<p>4. A. Franky So Organic Electronics, CRC Press 2010.</p> <p>1. M.F. Gray Polymer Electrolytes</p> <p>2. G. Inzlet, Conducting Polymers</p> <p>3. P.G. Bruce, Solid State Electrochemistry, Cambridge University press 2000</p>
	eResources addresses	<p>Supplementary</p> <p>https://enauczenie.pg.edu.pl/2025/course/view.php?id=1092 -</p>
Example issues/ example questions/ tasks being completed	<p>1. The mechanism of charge transport in amorphous polyoxyethylene electrolytes containing lithium salts</p> <p>2. Methods for obtaining the so-called conjugated polymers. synthetic metals.</p> <p>3. The theory of hard and soft acids and bases HSAB in application to describe the coordinate systems of polymeric solid electrolytes.</p> <p>4. Polyaniline as an example of the electrochromic compound.</p>	
Practical activities within the subject	Not applicable	

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