GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2022	Academic year of realisation of subject	2025/2026
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		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Anna Lisowska-Oleksiak	
	Teachers		

Lesson types and methods of instruction

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

Additional information:
The teaching subject has 3 components. Lecture -performed using the traditional methods, through oral presentation of factual material based on literature supported by a pptx presentation. The materials were prepared in the form of a lecture script and in the form of presentations available during teaching.

Laboratories - requires students to conduct syntheses and measurements on their own based on prepared instructions provided in the form of PDF files. Passing the laboratory requires preparing Reports and obtaining a positive grade on the Reports and tests proving preparation for the laboratory.

Project - the work consists in conducting literature studies (with the help of an academic teacher and preparing a written essay which is a technical descibtion of a selected device using organic conductive materials. The device should be potentially useful in biomedical applications. Students consult their concepts and way of realization at every stage of the task concerning technological and chemical approach. Passing this part of the course is obtaining a positive grade for the design/development and a positive grade for presenting the concept orally during a presentation.

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_U52] can determine properties of materials and biomaterials used in biomedical engineering	The student is able to determine and determine the properties of conductive materials and assess their usefulness in biomedical engineering	[SU1] Assessment of task fulfilment [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	The student understands at an advanced level issues related to selected aspects of materials science of organic current conductors, constituting general knowledge related to the field of study.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	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 caso called Synthetic Metals like polyaniline, polypyrrole, polythiophene. Methods of preparing, electrical properties. 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. Carbon materials with graphene planes; nanomaterials. B) Laboratory I) Synthesis and properties of the polymer "synthetic metal "(polypyrrole, polythiophene). - Manual.pdf II) Determination of the capacity of the electric charge of the material by means of impedance spectroscopy. Manual.pdf IV) Electrochromic properties of polyaniline. Examination of the polymer layer whch changes color under the influence of an electric field. The use of potentiostat. Manual pdf V) Low molecular electroluminescent layer. Preparation method (dip coating) and spin coating) manual pdf VI) construction of modified enzyme electrodes containing redox centers of transition metal atoms (such as glucose oxidase) to the cell glucose C) PROJECT GROUP Topics exemplary academic year 2014/20145 - 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	Chemistry: General aspects : Structure of matter, chemical bonds, chemical compounds. The issue detailed: Physical chemistry, thermodynamic equilibrum, kinetics. Basic knowledge about synthesis of macromolecules. Chemistry of complex compounds, supramolecular chemistry.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
exam: oral or written	50.0%	60.0%
quality of project and quality of the presentation given on group meeetings	100.0%	20.0%
laboratory reports and tests - quality	100.0%	20.0%

Recommended reading	Basic literature	1. Lecture course (ppt files) 2. Laboratory manuals (pdf files) 3. Franky So, Organic Electronics, CRC Press 2010 4.R.W Kelsall, I.W. Hamley, M. Geoghegan , Nanoscience and nanotechnology
	Supplementary literature	4. A. Franky So Organic Electronics, CRC Press 2010. 1. M.F. Gray Polymer Electrolytes 2. G. Inzlet, Conducting Polymers 3. P.G. Bruce, Solid State Electrochemistry, Cambridge University press 2000
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. The mechanism of charge transport in amorphous polyoxyethylene electrolytes containing lithium salts 2. Methods for obtaining the so-called conjugated polymers. synthetic metals. 3. The theory of hard and soft acids and bases HSAB in application to describe the coordinate systems of polymeric solid electrolytes. 4. Polyaniline as an example of the electrochromic compound.	
Work placement	Not applicable	

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