



Subject card

Subject name and code	Master's thesis, PG_00048903						
Field of study	Biotechnology						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2024/2025		
Education level	second-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	2	Language of instruction			Polish Polish		
Semester of study	4	ECTS credits			20.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department Of Chemistry Technology And Biotechnology Of Food -> Faculty Of Chemistry -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Robert Tylingo					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	0.0	0.0	0.0	0
	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	0	15.0		485.0	500	
Subject objectives	The aim of this work is to assess the effect of chitosan molecular weight on the physicochemical, mechanical and functional properties of membranes used in the production of biodegradable fuel cells. The work aims to investigate how different molecular weights of chitosan affect such features as: ionic conductivity, thickness, mechanical properties of fuel cell membranes and their biological properties						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U08] can analyze patent documents, can make a preliminary assessment of the patentability of a product, process or substance, can use patent databases	Will acquire the ability to search and analyze patent documents regarding the use of desired compounds in the construction of fuel cell membranes. Will be able to make a preliminary assessment of the patentability of developed material solutions and effectively use specialized patent databases to identify the state of the art, also in the context of membranes having new biological properties	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
	[K7_W09] knows the concepts and principles of intellectual property protection and patent protection, bioethical problems and major legal regulations in the field of bioethics, the principles of experimental design and analysis of experimental results	Gain knowledge in the field of intellectual and industrial property protection, including the principles of patent protection of research results. Learn basic bioethical issues and applicable legal regulations regarding conducting biotechnological research. Know the principles of proper design of experiments and analysis of experimental results in accordance with good scientific practices.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_K04] is aware of the need to solve problems and perform tasks, independently formulate questions to solve a given problem or task; is able to plan the execution of a larger task by dividing it into partial tasks and draw up an appropriate schedule	The student will gain the ability to independently define a research problem and formulate questions leading to its solution. The student will be able to plan the implementation of a complex research task by dividing it into partial tasks, developing a work schedule and its systematic implementation within the framework of the diploma project.	[SK5] Assessment of ability to solve problems that arise in practice [SK3] Assessment of ability to organize work [SK2] Assessment of progress of work
	[K7_U09] is able to design experiments and analyze experimental results, is able to prepare and present papers, reports, documentation of experiments, technological processes using correct scientific and specialist terminology, and to prepare a correct bibliography	The student will acquire the ability to design research experiments and analyze the obtained results. Will be able to prepare and present reports and documentation of conducted research using appropriate scientific and specialist terminology. Will also acquire competence in the area of preparing a correct bibliography in accordance with applicable citation standards.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
Subject contents	<ul style="list-style-type: none"> • Formulating the topic of the diploma thesis and the research objective: • Selection of the topic consistent with the profile of the field/speciality, • Determination of the research objective and problem. • Review of the subject literature: • Analysis of scientific and patent literature on the subject of the thesis, • Development of a theoretical introduction and research background of the thesis. • Planning and organization of the research work: • Development of a work schedule, • Division of the task into partial stages (literature, experimental, analytical). • Designing and conducting the experiment: • Selection of materials, research methods and analytical tools, • Performing measurements, observations and laboratory analyses. • Analysis and interpretation of results: • Development of data, graphs, tables, • Discussion of results in the context of the literature and the objectives of the thesis. • Principles of developing the text of the diploma thesis: • Structure of the thesis (introduction, experimental part, results, discussion, conclusions), • Principles of citing sources and creating a bibliography. Preparation of documentation and presentation of results: • Editing the text of the thesis in accordance with the requirements of the faculty, • Preparation of the summary and the English version of the title and abstract, • Preparation of the presentation for the defense of the thesis. • Ethical issues and intellectual property: • Protection of research results, copyright, • Bioethics in scientific work. 		

Prerequisites and co-requisites	<p>The student should have:</p> <ol style="list-style-type: none"> 1. Theoretical and practical knowledge in the field of biotechnology, chemistry and materials engineering, enabling understanding and planning of experimental studies in the area of biopolymer materials, bioengineering and biological process technology. 2. The ability to conduct laboratory work, including knowledge of sample preparation techniques, conducting physicochemical measurements and applying basic analytical and statistical methods. 		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Preparation of a literature review in line with the topic of the work	60.0%	20.0%
	Realization of the research part of the work	60.0%	80.0%

Recommended reading	Basic literature	<p>Introduction to research methodology:</p> <ul style="list-style-type: none"> Babbie, E. <i>Podstawy badań społecznych</i>. Warszawa: Wydawnictwo Naukowe PWN. Sęk, H. (red.). <i>Redagowanie prac dyplomowych i naukowych</i>. Warszawa: PWN. <p>Biomaterials and chitosan:</p> <ul style="list-style-type: none"> Sionkowska, A. <i>Biopolimery i biomateriały</i>. Wydawnictwo Naukowe UMK. Rinaudo, M. (2006). <i>Chitin and chitosan: Properties and applications</i>. <i>Progress in Polymer Science</i>, 31(7), 603632. <p>Fuel cells and biocells</p> <ul style="list-style-type: none"> Shukla, A., Suresh, P., Berchmans, S., & Rajendran, A. (2004). <i>Biological fuel cells and their applications</i>. Santoro, C., Babanova, S., & Atanassov, P. (2015). <i>From Chemical Fuel Cells to Biological Fuel Cells: Challenges and Directions</i>. <i>Electrochemical Society Transactions</i>. <p>Research methods and analysis of results:</p> <ul style="list-style-type: none"> Miller, J. N., & Miller, J. C. <i>Statistics and Chemometrics for Analytical Chemistry</i>. Pearson Education. Walczak, B. <i>Metody analizy danych w chemometrii</i>. PWN. <p>Intellectual Property Protection and Bioethics:</p> <ul style="list-style-type: none"> Mikołajczyk, M. <i>Własność intelektualna w ochronie zdrowia i biotechnologii</i>. Wolters Kluwer. Hartman, J. <i>Bioetyka. Zarys wykładu</i>. Wydawnictwo Naukowe PWN. <p>Writing scientific papers and citing sources:</p> <ul style="list-style-type: none"> Eco, U. <i>Jak napisać pracę dyplomową?</i> Warszawa: Wydawnictwo Uniwersytetu Warszawskiego. Day, R. A., Gastel, B. <i>Jak pisać i redagować prace naukowe</i>. Warszawa: PWN.
	Supplementary literature	<p>Scragg, A. H. <i>Biotechnology for Engineers: Biological Systems in Technological Processes</i>, Oxford University Press, 2005.</p>
	eResources addresses	Adresy na platformie eNauczanie:

<p>Example issues/ example questions/ tasks being completed</p>	<p>Application of natural biopolymers in materials engineering and environmental biotechnology Characterization of chitosan as a biologically derived material, its biodegradability, biocompatibility, and potential for use in sustainable technologies.</p> <p>Impact of physicochemical properties of biopolymers on their application in bioenergy systems Analysis of how molecular weight and polymer structure affect ion conductivity, permeability, and material stability in fuel cells.</p> <p>Biotechnological approach to the design of functional membrane materials Use of knowledge in material biotechnology and polymer chemistry for the fabrication and optimization of biodegradable membranes.</p> <p>Evaluation of biocompatibility and application potential of biotechnological materials The importance of biocompatibility and biodegradability parameters for the implementation of chitosan-based materials in environmental and medical technologies.</p> <p>Biotechnological aspects of sustainable development in the context of bioenergetics Analysis of the potential of biotechnology in the development of alternative energy sources, such as biological and microbial fuel cells using renewable, natural raw materials</p>
<p>Work placement</p>	<p>Not applicable</p>

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