



Subject card

Subject name and code	Macromolecular Materials Engineering, PG_00063529						
Field of study	Materials Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject				2025/2026	
Education level	second-cycle studies	Subject group				Obligatory subject group in the field of study 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	
Semester of study	3	ECTS credits				2.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Polymer Technology -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Janusz Datta				
	Teachers		prof. dr hab. inż. Janusz Datta				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	15.0	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		15.0	50
Subject objectives	Knowledge of structure-property relationships in polymers and methods of their characterization						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W06] Knows the theoretical basics the functioning of scientific equipment in the fields of science and scientific disciplines relevant to materials engineering.	The student knows the theoretical basis of functioning of research equipment appropriate for polymers testing			[SW1] Assessment of factual knowledge		
	[K7_U03] Can formulate a research hypothesis, design an experiment needed to prove it and use properly selected measuring and laboratory methods.	Student is able to design research tasks, which permit to determine properties of plastics and factors responsible for their failure			[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject		
	[K7_W02] Knows experimental, observatory and numerical techniques, as well as methods of building mathematical models relevant to materials engineering; can independently recreate basic theorems and laws, and their proofs.	The student knows experimental techniques (including spectroscopic, chromatographic and thermal analysis techniques) appropriate for polymeric materials			[SW1] Assessment of factual knowledge		
	[K7_U04] Can undertake a detailed analysis of the obtained results and develop a technical report or presentation, also in English.	The student is able to make a detailed analysis of the results from polymers testing			[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment		

Subject contents	<p>Introduction: Classification of polymers and their characterization. Crystalline and amorphous polymers. Physical states and viscoelastic properties of polymers. Average molecular weight and bimodal polymers. Characterization of plastics using spectroscopic (FTIR, NMR), chromatographic (HPLC, GPC), microscopic (SEM, TEM, AFM), thermal analysis (DSC, DMTA, TGA) and other techniques.</p> <p>Durability and degradation of plastics: Classification of polymer degradation processes. Functional additives for plastics preventing their degradation (e.g. antioxidants, photostabilizers and flame retardants).</p> <p>Analysis of plastics failure: Procedure, selection of testing techniques and analysis of obtained results. Analysis of exemplary plastics failures. Elements of monomers, polymers and functional additives toxicology.</p> <p>Physicochemistry of polymers surface: Polymer surface structure. Methods of polymer surface testing and modification</p> <p>Tribology of polymers: Mechanical-molecular theory of friction. Direct contact area during the friction of polymers. Mechanical and adhesive interactions. Influence of polymer structure and temperature on polymers friction coefficient. Physico-chemical phenomena occurring during polymer friction. Effects of lubricants. Modification of tribological properties of polymers. Triboelectric effect. Tribological wear.</p> <p>Recycling of plastics and environment protection: Sources of plastics waste, recycling methods, domestic and European Union regulations. Microplastics in environment: formation, identification and consequences of their presence in the environment. Plastics obtained using bio-based substances. Biodegradable plastics.</p>											
Prerequisites and co-requisites	Basic knowledge in the area of chemistry and technology of polymers											
Assessment methods and criteria	<table border="1" data-bbox="448 976 1487 1104"> <thead> <tr> <th data-bbox="448 976 798 1010">Subject passing criteria</th> <th data-bbox="802 976 1142 1010">Passing threshold</th> <th data-bbox="1147 976 1487 1010">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1016 798 1043">written tests (three in the term)</td> <td data-bbox="802 1016 1142 1043">50.0%</td> <td data-bbox="1147 1016 1487 1043">50.0%</td> </tr> <tr> <td data-bbox="448 1050 798 1104">written and oral works during seminar</td> <td data-bbox="802 1050 1142 1104">50.0%</td> <td data-bbox="1147 1050 1487 1104">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	written tests (three in the term)	50.0%	50.0%	written and oral works during seminar	50.0%	50.0%
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Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Factors responsible for polymers degradation 2. Degradability of polyolefins, polyamides and polyesters. 3. Mechanisms of action of degradation stabilizers and antioxidants. 4. Factors and processes causing failure of plastic products. 5. Methods of testing the tribological properties of plastic 											
Work placement	Not applicable											

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