

FACULTY OF CHEMISTRY

**SUBJECT CARD****Name of subject in Polish** Nowoczesne wielkocząsteczkowe materiały inżynierskie**Name of subject in English** Modern macromolecular engineering materials**Main field of study (if applicable):** Chemical Engineering and Technology**Specialization (if applicable):** Advanced Chemical Technologies**Profile:** academic**Level and form of studies:** 2nd level studies, full-time**Kind of subject:** obligatory**Subject code** W03CET-SM2016W, W03CET-SM2016L**Group of courses:** NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		45		
Number of hours of total student workload (CNPS)	75		75		
Form of crediting (Examination / crediting with grade)	exam		credit		
For group of courses mark (X) final course					
Number of ECTS points	3		3		
including number of ECTS points for practical classes (P)			3		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1,2		1,8		

\*delete as not necessary

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Basic knowledge of polymer chemistry and physical chemistry.

**SUBJECT OBJECTIVES**

C1 to acquaint students with the current knowledge of advanced polymeric engineering materials

C2 to acquaint students with the properties, methods of production and areas of application of macromolecular compounds

C3 to familiarize students with 3D printing techniques, polymer processing and recycling methods.

**SUBJECT EDUCATIONAL EFFECTS****relating to knowledge:**

Student, who has completed the course:

PEU\_W01 has knowledge of the properties of polymeric engineering materials.

PEU\_W02 knows the basic methods of obtaining polymeric engineering materials.

PEU\_W03 has knowledge of the application areas of polymeric engineering materials.

PEU\_W04 has a basic understanding of advanced macromolecular and composite engineering materials.

**relating to skills:**

Student, who has completed the course:

PEU\_U01 is familiar with selected 3D printing techniques

PEU\_U02 is able to select the appropriate processing method to obtain the desired product form

PEU\_U03 is familiar with selected mechanical and chemical recycling methods for plastics.

<b>PROGRAMME CONTENT</b>		
<b>Lecture</b>		<b>Number of hours</b>
Lec 1	Polymeric engineering materials - introduction.	2
Lec 2	Processing of polymeric engineering materials.	2
Lec 3	Laser modification of polymers.	2
Lec 4	Biomedical elastomers.	2
Lec 5	Modern natural polymers.	2
Lec 6	3D printing techniques	2
Lec 7	Polymer fibers.	2
Lec 8	Photoactive polymer materials.	2
Lec 9	Polymer recycling.	2
Lec 10	Magnetic polymer composites.	2
Lec 11	Polymer nanostructures.	2
Lec 12	Polymeric materials with ion-exchange properties.	2
Lec 13	Polymeric sorbents.	2
Lec 14	Forecasts for the development of polymeric engineering materials.	2
Lec 15	Summary of lectures and credit colloquium.	2
	Total hours	<b>30</b>
<b>Laboratory</b>		<b>Number of hours</b>
Lab 1	Introduction, health and safety rules and organizational information	3
Lab 2	Object-oriented design and creating details for 3D printing.	3
Lab 3	Filament production and FDM 3D printing.	3
Lab 4	Application of photoinitiated polymerization in 3D printing.	3
Lab 5	Extrusion of multilayer foil.	3
Lab 6	Plastic recycling – chemical methods.	3
Lab 7	Plastic recycling – mechanical methods.	3
Lab 8	Polymer hydrogels.	3
Lab 9	Electrospinning of nanofibers.	3
Lab 10	Magnetic polimer composites.	3
Lab 11	Biomedical elastomers.	3
Lab 12	Polymeric porous materials.	3
Lab 13	Polymeric materials with ion-exchange properties.	3
Lab 14	Polymeric sorbents.	3
Lab 15	Making up for not completed exercises.	3
	Total hours	<b>45</b>
<b>TEACHING TOOLS USED</b>		
N1. Multimedia presentation		
N2. Problem lecture		

**EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT**

<b>Evaluation</b> (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F1	PEU_U01 – PEU_U03	Summary reports
F2	PEU_U01 – PEU_U03	Final test
<b>P1</b> (lecture)	PEU_W01 – PEU_W04	Final test
<b>P2</b> (laboratory)	grade = (F1 + F2) / 2	
<b>PRIMARY AND SECONDARY LITERATURE</b>		
<b><u>PRIMARY LITERATURE:</u></b>		
<p>[1] Elnashar, M., Biopolymers, 2019, IntechOpen.  [2] Han, C.D., Rheology and Processing of Polymeric Materials Volume 2: Polymer Processing, 2006, Oxford University Press  [3] Su W.-F., Principles of Polymer Design and Synthesis, 2013, Springer  [4] Niaounakis, M., Biopolymers: Processing and Products, 2015, Elsevier</p>		
<b><u>SECONDARY LITERATURE:</u></b>		
<p>[1] Ji, W. (Ed.), Smart Polymer Hydrogels: Synthesis, Properties and Applications - Volume I, 2023, MDPI</p>		
<b>SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)</b>		
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