



### MODULE DESCRIPTION

Module code	full-time studies:	<b>Z-ZIP1-E-306</b>
	part-time studies:	<b>Z-ZIPN1-E-306</b>
Module name	<b>Plastics and composites</b>	
Module name in Polish	<b>Tworzywa sztuczne i kompozyty</b>	
Valid from academic year	<b>2023/2024</b>	

### MODULE PLACEMENT IN THE SYLLABUS

Field of study	<b>MANAGEMENT AND PRODUCTION ENGINEERING</b>
Level of education	<b>1st degree</b>
Studies profile	<b>General</b>
Form and method of conducting classes	<b>Full-time and Part-time</b>
Specialisation	<b>All</b>
Unit conducting the module	<b>Department of Production Engineering</b>
Module co-ordinator	<b>Rafał Chatys, PhD, DSc</b>
Approved by:	<b>Dariusz Bojczuk, PhD, DSc</b>

### MODULE OVERVIEW

Type of subject / group of subjects	<b>Major</b>
Module status	<b>Compulsory</b>
Language of conducting classes	<b>English</b>
Module placement in the syllabus - semester	<b>Semester III</b>
Initial requirements	<b>No requirements</b>
Examination (YES/NO)	<b>NO</b>
Number of ECTS credit points	<b>1</b>

Method of conducting classes		Lecture	Classes	Laboratory	Project	Other
Per semester	full-time studies:	<b>15</b>				
	part-time studies:	<b>9</b>				

## TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	A student has knowledge of materials, their selection and application in the production and device utilisation.	ZIP1_W07 ZIP1_W09 ZIP1_W18
	W02	A student has knowledge as regards material and product quality assurance during the manufacturing process.	ZIP1_W07 ZIP1_W09
Skills	U01	The student is able to assess the quality of the physical and mechanical properties of polymer components.	ZIP1_U19
Social competences	K01	A student understands the necessity of continuous improving his/her knowledge as regards new materials and technologies and to transfer it to the society.	ZIP1_K01 ZIP1_K06

## TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	<p>The importance of polymer components in human life. Trends and a short history of the development of polymer components as a construction material (plastic and composite).</p> <p>Classification, structure, structure of plastics and physical states of components with a polymer matrix. Explanation of issues: plastic, component, composite, layered composite (laminated), sandwich composite, reinforcement, matrix (matrix), preform, laying angle, hardener, inhibitor, resin mixture. Principles of selection of polymer matrix components (as "polymer compositions") with miscibility aspects of polymer components.</p> <p>Review and functions of especially fibrous reinforcements (solid phases, i.e. fibers: carbon, glass, aramid in the form of fabrics or mats: unidirectional, cross, twill, sewn, roving) and matrices (dispersed phase) on the example of the assortment of companies operating on the market. Natural polymers. Parameters characterizing the performance of polymer components. Polymers with fullerene structures. Plasma polymers.</p> <p>Basic methods of testing mechanical, flammable, thermal, electrical properties (conductivity, electrostatic interaction, static electricity on polymers), electrical insulating or physical properties (such as water absorption, parameters in moderate and cold climates: humidity, temperature, UV radiation, polymer aging).</p> <p>Comparative analysis of the influence of technological parameters (overpressure, negative pressure, resin mixture flow, hardening, gelling, ...) in the production of fibrous composites with a polymer matrix in closed forms (methods: RTM, light - RTM, vacuum bag or infusion) and classic methods (such as "wet" lamination, autoclave).</p> <p>Overview of basic devices (applicators) for forcing the resin mixture under pressure into the mold when forming polymer (fibrous) composites with vacuum methods.</p> <p>The use of statistical criteria in determining the quality of the physical and mechanical properties of polymer components (ie the ability to evaluate the distribution of the experimental data set, taking into account the complexity of the structure of the layers in the laminate).</p> <p>The impact of polymer components on the environment. Current directions of development of components with a polymer matrix. Biomaterials. Implants.</p>

## METHODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes <i>(select X)</i>					
	Oral exam	Written exam	Test	Project	Statement	Other
W01			X			
W02			X			
U01						X
U02			X			
K01						X

## FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Credit with grade	Test in the form of open questions - in the form of two tests. The writer draws a ticket with a prepared set of questions in the field of plastics (1st test) and composites (2nd test).

## STUDENT WORKLOAD

Balance of ECTS points												
No.	Type of student's activity	Student's workload										Unit
		full-time					part-time					
		Lc	C	Lb	P	O	Lc	C	Lb	P	O	
1.	Participation in the activities	15					9					h
2.	Other (consultation, exam)	2					2					h
3.	<b>Number of hours of a student's assisted work</b>	<b>17</b>					<b>11</b>					h
4.	<b>Number of ECTS credit points which are allocated for assisted work</b>	<b>0,7</b>					<b>0,4</b>					ECTS
5.	<b>Number of hours of a student's unassisted work</b>	<b>8</b>					<b>14</b>					h
6.	<b>Number of ECTS credit points which a student receives for unassisted work</b>	<b>0,3</b>					<b>0,6</b>					ECTS
7.	<b>Work input connected with practical classes</b>	<b>0</b>					<b>0</b>					h
8.	<b>Number of ECTS credit points which a student receives for practical classes</b>	<b>0,0</b>					<b>0,0</b>					ECTS
9.	<b>Total number of hours of a student's work</b>	<b>25</b>					<b>25</b>					h
10.	<b>Punkty ECTS za modul</b> <i>1 ECTS=25 hours</i>	<b>1</b>										ECTS

## LITERATURE

1. Altenbach H., Altenbach J., Kissing W. (2004), *Mechanics of Composite Structural Elements*, Springer -Verlag Berlin Heidelberg, New York.
2. Gibson Ronald F. (2007), *Principles of Composite Material Mechanics*, Publ. CRC Press, Taylor&Francis Group, Boca Ration-London-New York.
3. Mortensen A. (2007), *Concise Encyclopedia of Composite Material*, Publ. ELSEVIER, Singapur - London-New York.
4. Terry D.A. (2020), *Restoring with Flowables*, Quintessence Publishing Co.