



COURSE SPECIFICATION

Course code	full-time programme:	M#2-S1-ME-113
	part-time programme:	
Course title in Polish	Tworzywa sztuczne i materiały kompozytowe	
Course title in English	Plastics and composite materials	
Valid from (academic year)	2024/2025	

GENERAL INFORMATION

Programme of study	MECHANICAL ENGINEERING
Level of qualification	first-cycle
Type of education	academic
Mode of study	full-time programme
Specialism	all
Department responsible	Department of Maintenance, Laser and Nanoscale Technologies Weapons Engineering and Forensic Science
Course leader	dr hab. inż. Monika Madej, prof. PŚk dr hab. inż. Rafał Chatys, prof. PŚk
Approved by	dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering

COURSE OVERVIEW

Course type		programme-specific
Course status		compulsory
Language of instruction		English
Semester of delivery	full-time programme	Semester I
	part-time programme	
Pre-requisites		
Examination required (YES/NO)		NO
ECTS value		1

Mode of instruction		lecture	class	laboratory	project	seminar
No. of hours per semester	full-time programme	15				
	part-time programme					

LEARNING OUTCOMES





Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	The student knows and understands the basic physical, chemical, thermal and mechanical properties of plastics and composite materials, has knowledge in the field of mathematics to estimate the mechanical properties of layered composites (laminates), analysis of the operation of systems (pressure unit) used in automatic mixing and feeding of the system resin to the mold; analysis of flow and heat transfer in modeling the vacuum process in a fibrous preform (a package of components - layers in a laminate).	MiBM1_W01
	W02	The student has well-ordered, extended knowledge of the properties of composite structures, the use of engineering materials such as polymer matrix composites, and the use of engineering materials allowing for the proper selection of materials in the field of mechanical engineering.	MiBM1_W08
	W03	The student has advanced knowledge related to selected issues in the field of machine construction, technology of manufacturing basic elements of machines and devices, assessment of operational properties and wear, technology of manufacturing (forming) composite structures (laminates, sandwiches, sandwich and hybrid composites) with a polymer matrix used in the construction of machine and device components, knows and understands the basic processes occurring in the life cycle of devices.	MiBM1_W11
	W04	The student has the knowledge necessary to organize work in accordance with occupational health and safety regulations.	MiBM1_W19
	W05	The student has extended knowledge of the tribological properties of plastics.	MiBM1_W17
Competence	K01	The student is ready for the necessity of acquiring new skills useful in engineering activities and understands the need for continuous improvement (through second and third cycle studies, postgraduate studies, professional courses).	MiBM1_K01 MiBM1_K03

COURSE CONTENT





Type of instruction lecture	Topics covered
lecture	The importance of plastics in machine construction. The relationship between the structure and properties of plastics. Natural polymers. Polymer composites. Classification of polymers according to various criteria. Physical states of polymers. The influence of temperature on the mechanical properties of polymers. Performance properties of plastics and methods of their assessment. Plastic processing. Selection of plastics and composites for technical products used in machine construction. Basics of plastic recycling. Current directions of development of plastics and composites science. Basic definitions of the most important concepts related to composites. Hybrid composites. Review of computational (analytical) models for determining static and fatigue strength. The influence of operating conditions on the strength properties of polymer composites. Polymer aging. Comparative analysis of the influence of technological parameters in the production of polymer matrix composites in closed molds and classical methods. Discussion of the basic equipment for forming polymer (fibrous) composites using vacuum methods. Problems and prospects for the development of polymer-based materials. Biomaterials. Implants.

ASSESSMENT METHODS

Outcome code	Methods of assessment (<i>Mark with an X where applicable</i>)					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
W04			X			
W05			X			
K01						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	The pass mark is a minimum of 50% for all the in-class tests.

OVERALL STUDENT WORKLOAD

ECTS weighting												
No.	Activity type	Student workload										Unit
		full-time programme					part-time programme					
1.	Scheduled contact hours	L	C	Lb	P	S	L	C	Lb	P	S	h
		15										
2.	Other contact hours (office hours, examination)	2										h
3.	Total number of contact hours	17										h





4.	Number of ECTS credits for contact hours	0.7		ECTS
5.	Number of independent study hours	8		h
6.	Number of ECTS credits for independent study hours	0.3		ECTS
7.	Number of practical hours	0		h
8.	Number of ECTS credits for practical hours	0		ECTS
9.	Total study time	25		h
10.	ECTS credits for the course <i>1 ECTS credit = 25-30 hours of study time</i>	1		ECTS

READING LIST

1. Ashby M.F., Jones D.R.H., Materiały Inżynierskie. WNT Warszawa, 1996.
2. Praca zbiorowa pod red. M. Kozłowskiego, Podstawy recyklingu tworzyw sztucznych. Wyd. Politechniki Wrocławskiej, Wrocław, 1998.
3. Ochelski S. T., Metody doświadczalne mechaniki kompozytów konstrukcyjnych. WNT, Warszawa, 2004.
4. Praca zbiorowa pod red. L. Wojnara, Struktura i właściwości kompozytów na osnowie termoplastów. Wyd. Politechniki Krakowskiej, Kraków, 2005.
5. Ozimina D., Madej M., Tworzywa sztuczne i materiały kompozytowe. Wyd. Politechniki Świętokrzyskiej, Kielce, 2010.
6. Kubiński W., Materiałoznawstwo. Tom 2. Materiały do określonych zastosowań w różnych dziedzinach techniki. Wyd. AGH, Kraków, 2011.
7. Kubiński W., Materiałoznawstwo. Tom 1. Podstawowe materiały stosowane w technice. Wyd. AGH, Kraków, 2012.
8. Dzianok D., Postawa P., Zastosowanie nowoczesnych materiałów kompozytowych w przemyśle. Przetwórstwo tworzyw, 2015.
9. Trębacki K., Królicka A., Wpływ struktury materiałów kompozytowych na własności mechaniczne. Autobusy, Bezpieczeństwo i ekologia, 2017.
10. Krzyńska A., Kaczorowski M., Konstrukcyjne materiały metalowe, ceramiczne i kompozytowe. Oficyna Wydawnicza Politechniki Warszawskiej, 2020.
11. . Encyclopedia of Materials:Composites, Editor Dermot Brabazon, Publ. ELSEVIER, London-New York, 2021;
12. Altenbach H., Altenbach J., Kissing W.: Mechanics of Composite Structural Elements. Springer -Verlag Berlin Heidelberg, New York, 2004;
13. Boczkowska A., Kapuściński J., Lindemann Z., Witemberg-Pietrzyk D., Wojciechowski S.: Kompozyty Skrypt PW, Warszawa, 2013;
14. Królikowski W.: Polimerowe kompozyty konstrukcyjne, PWN, 2017;
15. Ashby Michael F., David R. H. Jones: Materiały inżynierskie, tom I. "Własności i zastosowanie" oraz tom II "Kształtowanie struktury i własności, dobór materiałów", WNT, Warszawa, 1998;
16. Ashby Michael F.: Dobór materiałów w projektowaniu inżynierskim. tom III., WNT, Warszawa, 1998;





17. Hauke Lengsfeld, Felipe Wolff-Fabris, Johannes Krämer, Javier Lacalle, Volker Altstadt: Composites Technology. Prepregs and Monolithic Part Fabrication Technologies Publisher Hanser Fachbuchverlag, 2021;
18. Kozioł M.: Nasycenie ciśnienowo-próżniowe zszywanych oraz tkanych trójwymiarowo preform z włókna szklanego. Seria Monografia 644, Wyd. PŚ, Gliwice, 2016;
19. Debdatta Ratna, Bikash Chandra Chakraborty. Polymer Matrix Composites materials, Structural and Functional and Applications, Publisher: Gruyter, Walter de GmbH, 2023;
20. Victor V. Tcherdyntsev, Reinforced Polymer Composites, Polymers (Basel). 2021, Published online 2021 Feb 13. doi: 10.3390/polym13040564;
21. German J.: Podstawy mechaniki materiałów włóknistych, Skrypt PK, Kraków, 1996;
22. Gibson Ronald F.: Principles of Composite Material Mechanics, Publ. CRC Press, Taylor&Francis Group, Boca Ration-London-New York, 2007;
23. Subramanian Senthilkannan Muthu Editor, Green Composites. Processing, Characterisation and Applications for Textiles, Springer, 2019;
24. Mortensen A.: Concise Encyclopedia of Composite Material, Publ. ELSEVIER, Singapur - Lon-don-New York, 2007;
25. New Polymeric Composite Materials, Environmental, Biomedical, Actuator and Fuel Cell Applications, Edited by Inamuddin, Ali Mohammad and Abdullah M. Asiri: Publisher Materials Research Forum LLC, 2016;
26. Żuchowska D.: Polimery konstrukcyjne. WNT, Warszawa, 2004.

