

# SYLLABUS

## Course description

Course code	Course	<b>NOWOCZESNE MATERIAŁY KONSTRUKCYJNE</b>		
MB/O/I/NST/C2A.10		<b>MODERN CONSTRUCTIONAL MATERIALS</b>		
Language of instruction	English			
Academic year	2023/2024			
<b>field of study:</b>	Mechanical engineering			
<b>field of specialisation:</b>	Designing and Manufacturing of Machines			
Educational level	first-cycle studies			
Education profile	General academic			
Mode of study	Part-time studies			
Semester(s)	6			
Affiliation with a group of classes	Specialization module			
Course status	obligatory			
Types of classes, instruction hours, ECTS credits	Types of classes	Number of instruction hours	Number of ECTS credits	
	Lecture	16 [h]	4 ECTS	
	Classes	[h]		
	Laboratory	16 [h]		
Linkage of the course	with the education profile	Associated with the conducted scientific activity in the discipline to which the field of study is assigned		4 ECTS
	with qualifications	It serves the student's acquisition of engineering competencies		4 ECTS
	with science discipline	Mechanical engineering		4 ECTS
Form of teaching	Traditional – classes organized at the University /classes conducted using online learning methods and techniques			
Prerequisites				
Department	Faculty of Mechanical Engineering			
Coordinator	dr inż. Wojciech Kucharczyk			
The website of the basic organizational unit	<a href="http://www.wm.uniwersytetradom.pl/">http://www.wm.uniwersytetradom.pl/</a>			
E-mail address, phone number of the coordinator	wojciech.kucharczyk@uthrad.pl, tel. 48 361 7680			

**LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES**

Learning Objective:	The aim of the course is to acquire the ability to select materials for responsible elements with high and special requirements and the ability to control their structure and properties.
Curriculum Content:	The content of the classes is related to the conducted scientific research. <b>Lecture.</b> Requirements for modern construction materials ( $R_m$ , $R_m$ , corrosion resistance). Relationships of material properties with its structure. Strengthening alloys. Construction materials in aviation technology. High-strength structural steels (for thermal improvement, martensitic precipitation hardening steels, corrosion-resistant steels, heat-resistant steels), heat treatment. Metal, ceramic and polymer composite materials, types of composites, structure, application. Creep-resistant and heat-resistant materials, characteristics, properties, materials with high specific strength. Materials resistant to low temperatures. Alloys with special physical properties and consumables, magnetic and non-magnetic materials. Corrosion resistant alloys. Wear-resistant materials. Ablative materials for thermal protection applications. <b>Laboratory (NB).</b> Structure of high-alloy and corrosion-resistant steels. Influence of deformation on properties and structure in deep drawing processes. Structure of light alloys and their heat treatment. Polymer composites - selection of components (matrix material, powder fillers, fiber reinforcement). Strength and specific stiffness of polymer composites. Research on thermal protective properties of ablative composites. Polymer materials resistant to abrasive wear. Electrical insulating materials. Evaluation of the properties of engineering ceramics.
Didactic (educational) methods:	<b>Lecture</b> - giving method (informative lecture). <b>Lab</b> - practical method (laboratory exercises).
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	The condition for passing the course is to achieve all the required learning outcomes specified for the subject. <b>Lecture:</b> written colloquium - grade point average for partial questions. <b>Laboratory classes</b> - the arithmetic mean of the grades obtained by the student for each laboratory exercise (the grade from the exercise is the average of the grades from the preliminary colloquium and individually prepared report).

Learning outcomes for the course in relation to the field of study learning outcomes and the type of classes				Methods of verifying learning outcomes	
Learning outcome number	Description of the learning outcomes for the course (PEU) A student who has passed the course ( <b>W</b> ) knows and understands / ( <b>U</b> ) can / ( <b>K</b> ) is ready to:	Field of study learning outcome (KEU)	Types of classes	Form of verification (credits)	Methods of testing and assessment
W1	It characterizes the requirements for modern construction materials (strength and operational properties) in terms of their physico-chemical and functional properties.	K_WG13 K_WG06	Lecture	Written test	Arithmetic mean of sub-question scores
W2	Explains the classification of material groups according to their properties and typical applications.	K_WG13 K_WG14	Lecture	Written test	Arithmetic mean of sub-question scores
W3	He describes the methods of strengthening metal alloys and changes in their mechanical parameters.	K_WG13	Lecture	Written test	Arithmetic mean of sub-question scores
W4	Defines the concepts of composite materials (types of composite classification, phase nomenclature).	K_WG13	Lecture	Written test	Arithmetic mean of sub-question scores

W5	He knows the physico-chemical basis for the selection of materials for products with special properties.	K_WG13 K_WG14	Lecture	Written test	Arithmetic mean of sub-question scores
U1	He can estimate the specific strength and stiffness of the material.	K_UW06	Laboratory classes	Passing individual practical exercises	Arithmetic average of grades from practical exercises
U2	Distinguish between homogeneous and heterogeneous materials. Distinguishes between typical structures of light metal alloys and structures of composite materials.	K_UW11	Laboratory classes	Passing individual practical exercises	Arithmetic average of grades from practical exercises
U3	Interprets lists (diagrams) of measurements of strength characteristics; friction wear; thermal protection properties of materials - polymer, ceramic, metallic; composite.	K_UW01 K_UK02	Laboratory classes	Passing individual practical exercises	Arithmetic average of grades from practical exercises
U4	It conducts the selection of materials in terms of their strength and operational properties for special applications.	K_UW11 K_UW14	Laboratory classes	Passing individual practical exercises	Arithmetic average of grades from practical exercises
K1	He is aware of the non-technical aspects of the activity of a mechanical engineer, including its social consequences and impact on the environment.	K_KO03 K_KR06	Lecture	Written test	Arithmetic mean of sub-question scores
K2	He is ready to analyze the tasks assigned for implementation in terms of defining priorities, serving the maximum effectiveness of the task and the comprehensive effects of its implementation.	K_KK02 K_KO05	Lecture	Written test	Arithmetic mean of sub-question scores

Literature and teaching aids

- [1] Ever J. Barbero (Editor): Multifunctional Composites. ISBN: 978-1-51-680452-8, 2016.  
 [2] Kucharczyk W., Mazurkiewicz A., Żurowski W.: Nowoczesne materiały konstrukcyjne. Wybrane zagadnienia. Wydanie III. Wyd. Politechniki Radomskiej. Radom. 2011.  
 [3] Rucki M., Kucharczyk W., Żurowski W., Hevorkian E.: New Engineering Materials: A Handbook (w druku). Wyd. UTH Radom, Radom 2023.  
 [4] Tordoff B., Bale H. (Editors): Engineering Materials: Metals and Alloys. Wiley-VCH GmbH. Weinheim. Germany 2022.  
 [5] Wojtkun F. Sołncew J. P.: Materiały specjalnego przeznaczenia. Wyd. II. Wyd. Politechniki Radomskiej. Radom. 2001.

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits

Attendance, participation	Student workload [h].		
	Other contact hours (IGK)	Student's self-study hours Classes without a teacher (ZBN)	Classes
Participation in lectures	X	X	16 [h]
Participation in laboratory classes	X	X	16 [h]
Meeting with teachers during their duty hours	4 [h]	X	X
Preparation for lectures / laboratory classes Preparation for credit (written test)	X	20 [h]/20 [h] 24 [h]	X
Total student workload	4 [h] / 0,2 ECTS	64 [h] / 2,5 ECTS	32 [h] / 1,3 ECTS
ECTS credits for the course	100 [h] / 4 ECTS		

Additional information, comments

In the case of students with special needs, including disabilities, and chronic illnesses, the methods and forms of verification of learning outcomes specified above (in the syllabus) are adapted to the individual needs of these students, as appropriate.

Detailed rules and forms of support for students with special needs, including those with disabilities and chronically ill, during classes, credits, and exams are specified in: University Regulations (Regulamin Studiów Uniwersytetu Technologiczno-Humanistycznego w Radomiu), Study Regulations (Zasady Studiowania), and Procedure for Ensuring Accessibility of the Educational Process to Students with Special Needs, Including Those with Disabilities and Chronically ill (Procedura dotycząca zapewnienia dostępności procesu kształcenia studentom ze szczególnymi potrzebami, w tym: z niepełnosprawnością, przewlekle chorych).