

SYLLABUS

Course description

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|---|---|---|------------------------|--------|
| Course code | Course | NOWOCZESNE MATERIAŁY KONSTRUKCYJNE | | |
| MB/O/I/ST/C2A.10 | | MODERN CONSTRUCTIONAL MATERIALS | | |
| Language of instruction | English | | | |
| Academic year | 2023/2024 | | | |
| field of study: | Mechanical engineering | | | |
| field of specialisation: | Designing and manufacturing of machines | | | |
| Educational level | first-cycle studies | | | |
| Education profile | General academic | | | |
| Mode of study | Full-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 | 30 [h] | 4 ECTS | |
| | Classes | [h] | | |
| | Laboratory | 30 [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 | http://www.wm.uniwersytetradom.pl/ | | | |
| 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

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|---|--|
| 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. Lecture. 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. Laboratory (NB). 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: | Lecture - giving method (informative lecture). Lab - 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. Lecture: written colloquium - grade point average for partial questions. Laboratory classes - 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 (W) knows and understands / (U) can / (K) 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 | 30 [h] |
| Participation in laboratory classes | X | X | 30 [h] |
| Meeting with teachers during their duty hours | 5 [h] | X | X |
| Preparation for lectures / laboratory classes Preparation for credit (written test) | X | 10 [h]/20 [h] 5 [h] | X |
| Total student workload | 5 [h] / 0,2 ECTS | 35 [h] / 1,4 ECTS | 60 [h] / 2,4 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).