## COURSE SPECIFICATION

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|---|---|---|
| Course code | full-time programme: | **M#2-S1-ME-204** |
| | 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**<br>**Weapons Engineering and Forensic Science** |
| Course leader | **dr hab. inż. Monika Madej, prof. PŚk**<br>**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 II** |
| | part-time programme | |
| Pre-requisites | | |
| Examination required (YES/NO) | | **NO** |
| ECTS value | | **2** |

| **Mode of instruction** | | **lecture** | **class** | **laboratory** | **project** | **seminar** |
|---|---|---|---|---|---|---|
| **No. of hours per semester** | full-time programme | | | **30** | | |
| | part-time programme | | | | | |

## LEARNING OUTCOMES

| Category of outcome | Outcome code | Course learning outcomes | Corresponding programme outcome code |
|---|---|---|---|
| Skills | U01 | The student is able to select appropriate engineering materials to ensure correct operation of the machine, is able to use the knowledge of basic sciences to formulate and solve engineering tasks in various areas of mechanics and machine construction, both at the design stage, selection of polymer-based components in particular, or production of composite structures (laminates), is able to evaluate, critically analyze and synthesize the obtained results and express their opinions and comments. | MiBM1_U01<br>MiBM1_U02<br>MiBM1_U14 |
| | U02 | The student is able to combine obtained information, analyze and interpret, draw conclusions, formulate and justify opinions. | MiBM1_U03 |
| | U03 | The student understands the importance of the occupational health and safety management system; is able to find his place in an industrial environment, meeting the principles of occupational health and safety, is able to plan and organize work for himself and his team in an effective and safe manner in accordance with the principles of safety, environmental protection, ergonomics and fire protection regulations, is able to work independently and in a team. | MiBM1_U17<br>MiBM1_U20 |
| 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<br>MiBM1_K03 |

## COURSE CONTENT

| Type of instruction lecture | Topics covered |
|---|---|
| laboratory | Processing of plastics and thermoplastic composites. Selection of injection parameters for plastics and composites. Injection of plastics and composites. Testing and assessment of mechanical properties of plastics and composites: tensile strength, bending, hardness, impact strength. Assessment of tribological properties of plastics and composites. Testing and evaluation of thermal properties of plastics and composites: determination of Vicat and HDT temperatures. Identification of macromolecular compounds.<br>Review of polymer matrix components used in forming polymer matrix laminate. Estimation of the exothermic peak during the cross-linking process of resin systems, taking into account the time and proportions of polymerization components. Predicting the strength of a layered composite. Forming an n-layer laminate with a polymer matrix using one of the methods of injecting resin under pressure into the mold (to choose from: infusion method, RTM method, I-RTM method, vacuum bag method). Comparison of the predicted and obtained strength values of the formed laminate after a static tensile test. Estimation of the strength of unidirectional composite and polymer matrix laminate, taking into account material constants. |

## ASSESSMENT METHODS

| Outcome code | Methods of assessment *(Mark with an X where applicable)* | | | | | |
|---|---|---|---|---|---|---|
| | Oral examination | Written examination | Test | Project | Report | Other |
| U01 | | | | | X | |
| U02 | | | | | X | X |
| U03 | | | | | X | |
| K01 | | | | | | X |

## ASSESSMENT TYPE AND CRITERIA

| Mode of instruction | Assessment type | Assessment criteria |
|---|---|---|
| laboratory | 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 |
| | | | | 30 | | | | | | | | |
| 2. | Other contact hours (office hours, examination) | | | 2 | | | | | | | | h |
| 3. | **Total number of contact hours** | **32** | | | | | | | | | | h |
| 4. | **Number of ECTS credits for contact hours** | **1,3** | | | | | | | | | | ECTS |

| | | | | |
|---|---|---|---|---|
| 5. | **Number of independent study hours** | **18** | | h |
| 6. | **Number of ECTS credits for independent study hours** | **0,7** | | ECTS |
| 7. | **Number of practical hours** | **50** | | h |
| 8. | **Number of ECTS credits for practical hours** | **2,0** | | ECTS |
| 9. | **Total study time** | **50** | | h |
| 10. | **ECTS credits for the course**<br>*1 ECTS credit = 25-30 hours of study time* | **2** | | ECTS |

## READING LIST


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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.
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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.
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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;
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17. Hauke Lengsfeld, Felipe Wolff-Fabris, Johannes Krämer, Javier Lacalle, Volker Altstädt: 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;

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20. Victor V. Tcherdyntsev, Reinforced Polymer Composites, Polymers (Basel). 2021, Published online 2021 Feb 13. doi: 10.3390/polym13040564;
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22. Gibson Ronald F.: Principles of Composite Material Mechanics, Publ. CRC Press, Taylor&Francis Group, Boca Ration-London-New York, 2007;
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25. New Polymeric Composite Materials, Environmental, Biomedical, Actuator and Fuel Cell Applica-tions, Edited by Inamuddin, Ali Mohammad and Abdullah M. Asiri: Publisher Materials Research Forum LLC, 2016;
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