



## Subject card

|   |   |   |          |                                     |  |            |     |
|---|---|---|----------|-------------------------------------|--|------------|-----|
| Subject name and code                       | Microscopy methods in nanotechnology, PG_00036989   |   |          |                                     |  |            |     |
| Field of study                              | Nanotechnology  |   |          |                                     |  |            |     |
| Date of commencement of studies             | October 2023  | Academic year of realisation of subject   |          |                                     | 2023/2024  |            |     |
| Education level                             | second-cycle studies  | Subject group   |          |                                     | Optional subject group<br>Subject group related to scientific research in the field of study |            |     |
| Mode of study                               | Full-time studies   | Mode of delivery  |          |                                     | at the university  |            |     |
| Year of study                               | 1   | Language of instruction   |          |                                     | English  |            |     |
| Semester of study                           | 1   | ECTS credits  |          |                                     | 3.0  |            |     |
| Learning profile                            | general academic profile  | Assessment form   |          |                                     | assessment   |            |     |
| Conducting unit                             | Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics                          |   |          |                                     |  |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor  | dr hab. inż. Jakub Karczewski   |          |                                     |  |            |     |
|   | Teachers  | dr hab. inż. Jakub Karczewski   |          |                                     |  |            |     |
| Lesson types and methods of instruction     | Lesson type   | Lecture   | Tutorial | Laboratory                          | Project  | Seminar    | SUM |
|   | Number of study hours   | 15.0  | 0.0      | 30.0                                | 0.0  | 0.0        | 45  |
|   | E-learning hours included: 0.0  |   |          |                                     |  |            |     |
| Learning activity and number of study hours | Learning activity   | Participation in didactic classes included in study plan  |          | Participation in consultation hours |  | Self-study | SUM |
|   | Number of study hours   | 45  |          | 5.0                                 |  | 25.0       | 75  |
| Subject objectives                          | Understanding modern methods of imaging nanostructures  |   |          |                                     |  |            |     |
| Learning outcomes                           | Course outcome  | Subject outcome   |          |                                     | Method of verification   |            |     |
|   | K7_W03  | The student has knowledge of modern microscopic methods   |          |                                     | [SW1] Assessment of factual knowledge  |            |     |
|   | K7_W04  | The student knows, understands and can perform measurements using SEM, AFM, STM microscopy          |          |                                     | [SW1] Assessment of factual knowledge  |            |     |
|   | K7_U05  | The student is able to prepare perform and interpret experiment in the field modern imaging methods |          |                                     | [SU1] Assessment of task fulfilment  |            |     |
|   | K7_U02  | The student is able to prepare perform and interpret experiment in the field modern imaging methods |          |                                     | [SU1] Assessment of task fulfilment  |            |     |
| Subject contents                            | optical microscopytunneling microscopyatomic force microscopyscanning electron microscopytransmission electron microscopy |   |          |                                     |  |            |     |
| Prerequisites and co-requisites             | Basic physics knowledge   |   |          |                                     |  |            |     |
| Assessment methods and criteria             | Subject passing criteria  | Passing threshold   |          |                                     | Percentage of the final grade  |            |     |
|   | lecture exam  | 50.0%   |          |                                     | 50.0%  |            |     |
|   | laboratory  | 50.0%   |          |                                     | 50.0%  |            |     |

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| Recommended reading  | Basic literature   | Weilie Zhou Zhong Lin Wang "Scanning Microscopy for Nanotechnology Techniques and Applications"<br><br>V. L. Mironov "Fundamentals of Scanning Probe Microscopy"  |
|  | Supplementary literature   | Nanosurf easyScan 2 - operating instruction   |
|  | eResources addresses   | Adresy na platformie eNauzanie:<br>Microscopy methods in nanotechnology - Moodle ID: 34187<br><a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=34187">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=34187</a> |
| Example issues/<br>example questions/<br>tasks being completed | principle of atomic force microscopy<br>limitations of the SEM microscopy<br>comparison of imaging methods of nanostructures |   |
| Work placement   | Not applicable   |   |