



Subject card

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|---|---|---|----------|-------------------------------------|--|------------|-----|
| Subject name and code | Nanotechnology, PG_00039822 | | | | | | |
| Field of study | Materials Engineering, Materials Engineering, Materials Engineering | | | | | | |
| Date of commencement of studies | October 2022 | Academic year of realisation of subject | | | 2024/2025 | | |
| Education level | first-cycle studies | Subject group | | | Obligatory subject group in the field of study 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 | 3 | Language of instruction | | | Polish | | |
| Semester of study | 6 | ECTS credits | | | 2.0 | | |
| Learning profile | general academic profile | Assessment form | | | assessment | | |
| Conducting unit | Division of Nanomaterials Physics -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Wojciech Sadowski | | | | | |
| | Teachers | | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 15.0 | 0.0 | 0.0 | 0.0 | 15.0 | 30 |
| | E-learning hours included: 0.0 | | | | | | |
| | Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=13039 | | | | | | |
| 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 | 30 | | 1.0 | | 19.0 | 50 |
| Subject objectives | To familiarize students with the properties of materials at the transition from the macro to nano techniques manufacturing of nanomaterials and their applications. | | | | | | |
| Learning outcomes | Course outcome | Subject outcome | | | Method of verification | | |
| | K6_U06 | The ability to integrate information, interpret it, as well as draw conclusions related to the science of materials. | | | [SU2] Assessment of ability to analyse information | | |
| | K6_K01 | Demonstrates the need to improve professional and personal competences; is aware of its own limitations and knows when to turn to experts, is able to find the right source material. | | | [SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice | | |
| | K6_W03 | Has basic knowledge in the field of materials science, nanotechnology and is able to connect the properties of materials with their structure and composition, knows the theoretical description of phenomena occurring in materials. | | | [SW1] Assessment of factual knowledge | | |
| | K6_U08 | The ability to prepare typical written works in Polish and English, appropriate for nanotechnology and materials science, concerning specific issues, using basic theoretical approaches, as well as various sources. | | | [SU1] Assessment of task fulfilment | | |

| Subject contents | <p>1. Historical Introduction to Nanotechnology</p> <p>2. Elements of solid state.</p> <p>3. The physical basis of nanotechnology and size effects - the structure of a 3D, 2D , 1D , 0D .</p> <p>4. Nucleation and crystallization.</p> <p>5. Methods for the preparation of nanomaterials : thin layer and the thin film structure , quantum wires and dots , nanopowders.</p> <p>6. Methods of examination of the nanomaterials.</p> <p>7. Fullerenes and nanotubes .</p> <p>8. Elements of superconductivity.</p> <p>9. Nanotechnology applications.</p> | | | | | | | | | | | |
|---------------------------------|--|--|--|--------------------------|-------------------|-------------------------------|----------------------------|--------|-------|----------------|-------|-------|
| Prerequisites and co-requisites | Physics of materials, Functional materials | | | | | | | | | | | |
| Assessment methods and criteria | <table border="1"> <thead> <tr> <th data-bbox="456 891 794 920">Subject passing criteria</th> <th data-bbox="799 891 1137 920">Passing threshold</th> <th data-bbox="1142 891 1469 920">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 927 794 956">Examination of the seminar</td> <td data-bbox="799 927 1137 956">100.0%</td> <td data-bbox="1142 927 1469 956">30.0%</td> </tr> <tr> <td data-bbox="456 963 794 992">Credit lecture</td> <td data-bbox="799 963 1137 992">50.0%</td> <td data-bbox="1142 963 1469 992">70.0%</td> </tr> </tbody> </table> | | | Subject passing criteria | Passing threshold | Percentage of the final grade | Examination of the seminar | 100.0% | 30.0% | Credit lecture | 50.0% | 70.0% |
| Subject passing criteria | Passing threshold | Percentage of the final grade | | | | | | | | | | |
| Examination of the seminar | 100.0% | 30.0% | | | | | | | | | | |
| Credit lecture | 50.0% | 70.0% | | | | | | | | | | |
| Recommended reading | Basic literature | <p>Nanostructures and Nanomaterials. Synthesis, Properties and Applications. Imperial College Press. Guozhong Gao. 2004.</p> <p>Introduction to Nanotechnology. Ch.P.Poole Jr., F.J.Owens. Wiley. 2003.</p> <p>Nanoelectronics and Information Technology. Advanced Electronic Materials and Novel Devices. Reiner Waser (Ed.) Wiley-VCH. 2003.</p> <p>Nanomaterials: Synthesis, properties and Applications. Ed. by Edelstein A.S and Commarta R.S. IOP London 1996.</p> <p>F.E. Fujita. Physics of New Materials. Springer 1999.</p> | | | | | | | | | | |
| | Supplementary literature | <p>Nanomaterials: Synthesis, properties and Applications. Ed. by Edelstein A.S and Commarta R.S. IOP London 1996.</p> <p>F.E. Fujita. Physics of New Materials. Springer 1999.</p> | | | | | | | | | | |
| | eResources addresses | Adresy na platformie eNauczanie: | | | | | | | | | | |

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| <p>Example issues/ example questions/ tasks being completed</p> | <ol style="list-style-type: none"> 1. Elements of the structure of a solid (crystallography, chemical bonds, band stature) 2. Physical basis of nanotechnology and size effects - 3D, 2D, 1D, 0D structures. 3. Fundamentals of the synthesis of nanostructures, nucleation and crystallization. 4. Methods of obtaining nanomaterials: thin layers and thin-layer structures, quantum wires and dots, nanopowders, 5. Electrical, magnetic, optical and mechanical properties of nanostructures. 6. Methods of studying nanomaterials. STM microscopy, AFM. 7. Fullerenes and nanotubes. 8. Nanotechnology in applications |
| <p>Work placement</p> | <p>Not applicable</p> |

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