## Subject card

| Subject name and code | NANOTECHNOLOGY, PG_00063190 | | | | | |
|---|---|---|---|---|---|---|
| Field of study | Chemical Technology | | | | | |
| Date of commencement of studies | February 2025 | | Academic year of realisation of subject | | 2024/2025 | |
| Education level | second-cycle studies | | Subject group | | Obligatory subject group in the field of study | |
| Mode of study | Full-time studies | | Mode of delivery | | at the university | |
| Year of study | 1 | | Language of instruction | | Polish | |
| Semester of study | 1 | | ECTS credits | | 5.0 | |
| Learning profile | general academic profile | | Assessment form | | exam | |
| Conducting unit | Department of Inorganic Chemistry -> Faculty of Chemistry | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr inż. Andrzej Okuniewski | | | |
| | Teachers | | dr inż. Andrzej Okuniewski | | | |

| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|---|
| | Number of study hours | 15.0 | 0.0 | 15.0 | 30.0 | 0.0 | 60 |
| | E-learning hours included: 0.0 | | | | | | |
| | Additional information: Lectures will be conducted remotely using the eNauczanie and MS Teams platforms. The computer project and laboratory sessions will be held on-site in the rooms specified in the class schedule. | | | | | | |

| 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 | 60 | 5.0 | 60.0 | 125 |

| Subject objectives | The aim of the course is to acquaint students with the history, present state and future prospects of nanotechnology - an interdisciplinary field combining achievements in physics, chemistry, biology, material science, and many others. Awareness of technological capabilities at the nanoscale will give future graduates a chance to use them in their work. |
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| Learning outcomes | Course outcome | Subject outcome | Method of verification |
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| | [K7_U09] prepares documentation of experiments and technological processes using professional terminology | The student is able to prepare reports on the laboratory experiments and project work carried out. They describe synthesis and characterization processes of nanostructures using proper nanotechnology terminology. | [SU5] Assessment of ability to present the results of task |
| | [K7_W03] selects methods of data analysis, including statistical and modelling, useful for solving scientific and technological problems | The student can identify and choose suitable computational methods and data analysis techniques to solve specific nanotechnology-related problems. They understand the principles and limitations of each method and can evaluate the suitability of a given method for a particular problem. | [SW1] Assessment of factual knowledge<br>[SW3] Assessment of knowledge contained in written work and projects |
| | [K7_U01] designs experiments using computer methods of data analysis, computer simulations and based on the state of the knowledge in accordance with the latest scientific literature | The student is able to plan and conduct computer simulations to design nanostructures, analyze their properties, and investigate nanoscale phenomena. As part of the computer project, the student selects appropriate modeling methods and verifies the obtained results against the scientific literature. | [SU1] Assessment of task fulfilment<br>[SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools |

| Subject contents | **Lecture:** Molecular modeling. History of nanotechnology. Nanolithography. Nanoelectronics. Computer data storage. Structural research. Coordination and supramolecular chemistry. Carbon nanostructures. Quantum effects in nanostructures. 0-3D nanostructures. Calculation exercises.<br><br>**Project:** Students become acquainted with the basics of molecular modeling and design nanodevices by themselves.<br><br>**Laboratories:** Students synthesise selected nanostructures and examine their properties.<br><br>A detailed program of the course as well as the project and laboratory are regularly updated and posted on the eNauczanie platform. |
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| Prerequisites and co-requisites | Completed courses at the undergraduate level in the following subjects: mathematics, physics, general, inorganic, organic and physical chemistry. |

| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|---|
| | Project | 60.0% | 30.0% |
| | Exam | 60.0% | 40.0% |
| | Laboratory | 60.0% | 30.0% |

| Recommended reading | Basic literature | • R. W. Kelsall, I. W. Hamley, M. Geoghegan: Nanotechnologie. *Wydawnictwo Naukowe PWN*, Warszawa 2008.<br>• Ch. P. Poole Jr., F. J. Owens: Introduction to Nanotechnology. *Wiley-Interscience Hoboken*, New Jersey 2003.<br>• B. Dręczewski, A. Herman, P. Wroczyński: Nanotechnologia stan obecny i perspektywy, *Wydawnictwo PG*, Gdańsk 1997. |
|---|---|---|
| | Supplementary literature | • K. Żelechowska: Nanotechnologia w chemii i medycynie. *Wydawnictwo PG*, Gdańsk 2014.<br>• E. Regis: Nanotechnologia. Narodziny nowej nauki, czyli świat cząsteczka po cząsteczce. *Prószyński i S-ka*, Warszawa 2001. |
| | eResources addresses | Adresy na platformie eNauczanie:<br><br>Nanotechnologia 2024/25 - Moodle ID: 43910<br>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=43910 |

| Example issues/ example questions/ tasks being completed | Available on the eNauczanie platform. |
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| Work placement | Not applicable |

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