GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | , PG_00046118 | | |
| Field of study | Technical Physics | | |
| Date of commencement of studies | February 2024 | Academic year of realisation of subject | 2024/2025 |
| Education level | second-cycle studies | Subject group | |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | Polish |
| Semester of study | 2 | ECTS credits | 2.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Instytut Fizyki i Informatyki Stosowanej -> Faculty of Applied Physics and Mathematics | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr Piotr Weber | |
| | Teachers | dr Piotr Weber | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30 |

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 | 30 | 4.0 | 16.0 | 50 |

**Subject objectives**

To familiarize students with the physical description of typical systems that belong to soft matter systems. To familiarize students with the physico-chemical properties of: liquid crystals, polymers, emulsions and colloids.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K7_W02] Has enhanced, theoretically-founded, detailed knowledge of selected field of physics, and sufficient knowledge of related fields of science or technology. | The student will obtain knowledge in the field of soft matter physics. Give examples of this type of matter and discuss its properties. He will know what models are used to describe this type of matter. | [SW2] Assessment of knowledge contained in presentation<br>[SW1] Assessment of factual knowledge |
| [K7_W03] Has general knowledge of current development paths and discoveries in the scope of physics and related fields of science and technology. | The student will obtain knowledge in the field of soft matter physics and its current directions of development. | [SW2] Assessment of knowledge contained in presentation<br>[SW1] Assessment of factual knowledge |

**Subject contents**

The lecture consists of several thematic parts. The first part concerns the microscopic, mesoscopic and macroscopic characteristics of soft matter systems. The characteristics of the spatial arrangement of molecules in this type of systems are also discussed. In this thematic part, basic information on the structure of molecules is recalled, methods of describing intermolecular interactions are discussed, and a mesoscopic description is introduced. The relationships between selected thermodynamic quantities appearing in the description of soft matter, including phase transitions and self-organization, are also discussed.The following sections discuss:

- processes occurring in colloidal systems; methods of obtaining colloidal systems and their stabilization; the role of the interfacial surface, the electrical double layer and the DVLO theory.
- selected models of the dynamics of polymer systems (elasticity of a single polymer molecule, Rouse model, Zimm model, Doi-Edwards theory);
- physico-chemical characteristics of polymer solutions. issues related to liquid crystals.

**Prerequisites and co-requisites**

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>exam</td><td>50.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>M. Kleman, O. D. Lavrentovich Soft Matter Physics, Springer, 2001<br><br>P. W. Atkins, Physical Chemistry, OUP Oxford, 2010</td></tr>
<tr><td>Supplementary literature</td><td>L. Piela Ideas of Quantum Chemistry, Elsevier, 2013</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Discuss the structure of a polymer molecule (polymer and copolymer?). In relation to the molecule polymer, explain the terms: primary structure, secondary structure (conformation),three-dimensional structure and quaternary structure.2. Describe the measure of stiffness of a polymer chain - persistent length. 3. Explain the concept of polymer chain conformation and conformational entropy. Pass itformula for conformational entropy in the case of a one-dimensional ball.4. Explain the concept of a colloidal system. How do we divide colloidal systems? Introduce the typescolloidal systems with examples.5. Describe the packing parameter for creating supramolecular structures from moleculeshaving hydrophobic and hydrophilic parts (amphiphilic molecules).</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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