

|    |                           |  |
|----|---------------------------|--|
| 1. | Nazwa kierunku            | biofizyka  |
| 2. | Wydział                   | Wydział Nauk Ścisłych i Technicznych   |
| 3. | Cykl rozpoczęcia          | 2022/2023 (semestr zimowy), 2023/2024 (semestr zimowy), 2024/2025 (semestr zimowy) |
| 4. | Poziom kształcenia        | studia drugiego stopnia  |
| 5. | Profil kształcenia        | ogólnoakademicki   |
| 6. | Forma prowadzenia studiów | stacjonarna  |

**Moduł kształcenia:** Molecular and Soft Condensed Matter

**Kod modułu:** W4-2BF-MB-21-12

1. Liczba punktów ECTS: 4

| 2. Zakładane efekty uczenia się modułu |  |                               |                                |
|--|--|-------------------------------|--------------------------------|
| kod                                    | opis   | efekty uczenia się kierunku   | stopień realizacji (skala 1-5) |
| MB_12_1                                | students will be able to describe the phases of single-component molecular systems, and the main experimental techniques available to study molecular dynamics and phase transitions                 | KBF_W02<br>KBF_W07<br>KBF_W10 | 4<br>4<br>4                    |
| MB_12_2                                | students will be able to discuss the (dynamic) disorder present in a phase and its impact on rheological/mechanical properties and on vitrification  | KBF_U01<br>KBF_U11<br>KBF_W02 | 4<br>4<br>4                    |
| MB_12_3                                | students will be able to describe the main theories that describe the properties of glasses, liquid crystals, linear polymers and polymer networks, as well as their main technological applications | KBF_U02<br>KBF_W02            | 3<br>4                         |

3. Opis modułu

|             |   |
|-------------|---|
| <b>Opis</b> | <p>This unit introduces the physics of molecular and macromolecular condensed phases such as liquids, glasses, liquid crystals, plastic and orientationally disordered crystals, polymers and polymer gels.</p> <p>Course syllabus:</p> <p>(1) Basics of molecular condensed matter: introduction (polymorphism, glasses, complex fluids: mesophases &amp; polymers); classification and mechanism of phase transitions (first order, continuous, glassy; nucleation and growth); van der Waals theory; microscopic constituents, effective interactions, disorder &amp; dynamics; experimental tools &amp; linear response theory; Boltzmann distribution and partition function</p> <p>(2) Single component systems: structural glasses, primary and secondary relaxations, aged and stable glasses; orientationally disordered solids and plastic crystals; amorphous and semicrystalline linear polymers; rotational isomeric state model; ideal chains and entanglement, normal and segmental relaxations; viscoelasticity; polymers networks, gelation and rubber elasticity; conjugated and conductive polymers; thermotropic liquid crystals and liquid</p> |
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|--------------------------|---|
|                          | crystal polymers)<br>(3) Introduction to binary systems and binary equilibrium and non-equilibrium phase diagrams: heterointeractions; glass-forming mixtures; binary plastic crystals; polymer blends, solutions, and dispersions; block copolymers; polymer gels and hydrogels, swelling; superhydrophobic, superhydrophilic/oleophobic, superamphiphilic, and self-healing polymer coatings.<br>Self-assembly in condensed matter: biopolymers, helix-coil & coil-globule transitions; surfactant-water systems, biomembranes, lyotropic liquid crystals, emulsions; semiflexible polymers & cytoskeleton; colloidal systems (glasses, crystals, nematics, gels);<br>Applications to drug encapsulation, controlled drug release, and drug delivery. |
| <b>Wymagania wstępne</b> |   |

| <b>4. Sposoby weryfikacji efektów uczenia się modułu</b> |                    |   |                                  |
|--|--------------------|---|----------------------------------|
| <b>kod</b>   | <b>nazwa (typ)</b> | <b>opis</b>   | <b>efekty uczenia się modułu</b> |
| MB_12_w_1  | egzamin            | Oral and written presentation of case study (60%), written midterm exam (40%) | MB_12_1, MB_12_2, MB_12_3        |

| <b>5. Rodzaje prowadzonych zajęć</b> |                                  |  |                      |  |                      |  |
|--------------------------------------|----------------------------------|--|----------------------|--|----------------------|--|
| <b>kod</b>                           | <b>rodzaj prowadzonych zajęć</b> |  |                      | <b>praca własna studenta</b>                     |                      | <b>sposoby weryfikacji efektów uczenia się</b> |
|                                      | <b>nazwa</b>                     | <b>opis (z uwzględnieniem metod dydaktycznych)</b>   | <b>liczba godzin</b> | <b>opis</b>                                      | <b>liczba godzin</b> |  |
| MB_12_fs_1                           | wykład                           | Detailed discussion by the lecturer of the issues listed in the table "module description" using the table and/or multimedia presentations | 36                   | Supplementary reading, working with the textbook | 64                   | MB_12_w_1                                      |