

|    |                           |                                      |
|----|---------------------------|--------------------------------------|
| 1. | Nazwa kierunku            | biofizyka                            |
| 2. | Wydział                   | Wydział Nauk Ścisłych i Technicznych |
| 3. | Cykl rozpoczęcia          | 2021/2022 (semestr zimowy)           |
| 4. | Poziom kształcenia        | studia drugiego stopnia              |
| 5. | Profil kształcenia        | ogólnoakademicki                     |
| 6. | Forma prowadzenia studiów | stacjonarna                          |

**Moduł kształcenia:** Biophysical and Materials Science Characterization

**Kod modułu:** W4-2BF-MB-21-14

**1. Liczba punktów ECTS:** 4

| 2. Zakładane efekty uczenia się modułu |   |                             |                                |
|--|---|-----------------------------|--------------------------------|
| kod                                    | opis  | efekty uczenia się kierunku | stopień realizacji (skala 1-5) |
| MB_14_1                                | students will be able to understand and describe the fundamental properties of aqueous solutions and complex materials  | KBF_U03                     | 4                              |
|  |   | KBF_U08                     | 4                              |
|  |   | KBF_W02                     | 4                              |
|  |   | KBF_W07                     | 4                              |
| MB_14_2                                | students will be able to describe the application of experimental physicochemical methods to the solid and liquid states and choose the appropriate experimental techniques that serve a specific purpose | KBF_U01                     | 3                              |
|  |   | KBF_U09                     | 3                              |
|  |   | KBF_W02                     | 4                              |
|  |   | KBF_W10                     | 4                              |

**3. Opis modułu**

|             |  |
|-------------|--|
| <b>Opis</b> | <p>The course aims to provide an introduction to chemical physics, especially on liquid solutions (both electrolyte and nonelectrolyte), solid solutions, and homogeneous and hybrid materials, and on the relevant characterization techniques.</p> <p>Course syllabus:</p> <p>(1) Introduction to inorganic chemical physics of electrolyte &amp; nonelectrolyte solutions<br/>         Types of solutions. Thermodynamics of solutions. Properties of water: The hydrogen bond, solubility of molecules in water, polar and non-polar solvents. Electrical permeability of water. Dissociation: acids and bases, protonation. Properties of solutions: functional groups, hydrophilic and hydrophobic interactions; solubility; diffusion. Colligative properties: boiling-point elevation, freezing point depression, osmotic pressure. Surface tension, capillarity. Water phase diagram and anomalies; aqueous electrolytes; non-electrolyte solutions. Electrostatics of salty solutions: biopolymers (polyelectrolytes) and biomembranes in water; Poisson-Boltzmann equation, Debye-Hückel model, electric double layers, ion, and proton conduction; transport properties.</p> <p>(2) Introduction to materials science properties</p> |
|-------------|--|

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|--------------------------|--|
|                          | <p>Cohesive interactions; structural and mechanical properties of homogeneous solids; organic molecular solids; non-miscible systems: morphology and properties of phase-separated materials</p> <p>(3) Laboratory techniques</p> <ul style="list-style-type: none"> <li>- Elemental analysis: photoelectron &amp; mass spectroscopy (XPS, UPS, Auger, secondary ion mass spectroscopy)</li> <li>- Chemical analysis: optical and vibrational spectroscopy (UV-vis, IR, Raman), nuclear magnetic resonance (NMR)</li> <li>- Morphological analysis: contact angle, powder X-ray diffraction (XRD), tomography (microCT), NMR-imaging, electron microscopy (SEM, TEM, energy loss/secondary electron spectroscopy)</li> <li>- Phase-change analysis</li> <li>- Mechanical, electrical, and optical characterization</li> <li>- A pharmaceutical application: optical measurement of the dissolution kinetics and solubility of a drug</li> </ul> <p>(4) Applications to pharmaceuticals, drug formulation, &amp; biophysical pharmacology:</p> <ul style="list-style-type: none"> <li>- Experimental techniques for electrolyte and non-electrolyte solutions</li> <li>- Small Molecules (drugs): HPLC, Chromatography, Mass spectroscopy, ICP-MS</li> <li>- Characterization of Nanoparticles: Molecular sizes (Dynamics light scattering, DLS), Surface charge (zeta potential, with conductivity measures)</li> <li>- Characterization of Biomolecules: chromatography, gel electrophoresis, Western Blot. Proteomics</li> </ul> |
| <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_14_w_1  | zaliczenie         | the basis for obtaining credit will be the grades from homework and laboratory reports | MB_14_1, MB_14_2                 |
| MB_14_w_2  | egzamin            | oral/written exam  | MB_14_1, MB_14_2                 |

| <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_14_fs_1                           | wykład                           | Detailed discussion by the lecturer of the issues listed in the table "module description" using the table and/or multimedia presentations | 30                   | Supplementary reading, working with the textbook, doing homework                                      | 44                   | MB_14_w_2                                      |
| MB_14_fs_2                           | laboratorium                     | Performance of exercises on the subject consistent with the issues listed in the table "module description"                                | 6                    | Acquiring knowledge in the scope of the exercise, preparation of the final report on a given exercise | 20                   | MB_14_w_1                                      |