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| 1. | <b>Field of study</b>          | <b>Chemistry</b>                  |
| 2. | Faculty                        | Faculty of Science and Technology |
| 3. | Academic year of entry         | 2023/2024 (summer term)           |
| 4. | Level of qualifications/degree | second-cycle studies              |
| 5. | Degree profile                 | general academic                  |
| 6. | Mode of study                  | full-time                         |

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| <b>7. General information about the module</b>                                    |   |
| <b>Module name</b>  | <b>Chemistry of the solid state</b>   |
| Module code   | W4-CH3-S2-1-CCS   |
| Number of the ECTS credits  | 6   |
| Language of instruction   | Polish  |
| Purpose and description of the content of education                               | <p>Moduł Chemia ciała stałego ma za zadanie wykształcenie umiejętności swobodnego posługiwania się podstawowymi pojęciami z zakresu budowy i chemii ciała stałego.</p> <p>Przewiduje się realizację następujących treści programowych:</p> <ol style="list-style-type: none"> <li>1. Budowa ciała stałego: opis struktury ciała stałego, teoria pola krystalicznego, struktura elektronową ciała stałego, model pasmowy ciała stałego, poziom Fermiego, powierzchnia ciała stałego.</li> <li>2. Defekty w ciele stałym: punktowe, liniowe, powierzchniowe. Roztwory substytucyjne i międzywęzłowe; oddziaływania między defektami; związki o składzie niestechiometrycznym.</li> <li>3. Procesy dyfuzyjne zachodzące w ciele stałym, fenomenologiczny opis dyfuzji, mechanizmy dyfuzji.</li> <li>4. Reakcje zachodzące w fazie stałej, mechanizmy tych reakcji, reakcje topochemiczne, efekt Kirkendalla, termodynamiczny i strukturalny model wydzielania się faz, reakcje w układach jedno- i wielofazowych.</li> </ol> |
| List of modules that must be completed before starting this module (if necessary) | not applicable  |

| <b>8. Learning outcomes of the module</b> |  |                                    |                                |
|---|--|------------------------------------|--------------------------------|
| Code                                      | Description  | Learning outcomes of the programme | Level of competenc (scale 1-5) |
| W4-CH3-S2-1-CCS_01                        | Ma wiedzę w zakresie historycznego rozwoju chemii ciała stałego i jest świadom znaczenia tego przedmiotu dla postępu nauk ścisłych oraz poznania świata i rozwoju ludzkości. | CH_W01                             | 4                              |
| W4-CH3-S2-1-CCS_02                        | Potrafi wyszukiwać niezbędne informacje na określony temat posługując się literaturą naukową, bazami danych i innymi źródłami.   | CH_U01                             | 4                              |
| W4-CH3-S2-1-CCS_03                        | Wykazuje odpowiedzialność za powierzony sobie zakres prac badawczych, za pracę własną i innych.  | CH_K03                             | 4                              |
| W4-CH3-S2-1-CCS_04                        | Krytycznie podchodzi do informacji rozpowszechnianych w mediach, szczególnie z zakresu nauk ścisłych.  | CH_K01                             | 4                              |
| W4-CH3-S2-1-CCS_05                        | Posiada podstawową wiedzę z zakresu budowy i właściwości ciał stałych, zna typy reakcji w fazie stałej.  | CH_W01                             | 4                              |

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| W4-CH3-S2-1-CCS_06 | Zna nowoczesne techniki pomiarowe stosowane w chemii ciała stałego.   | CH_W02 | 5 |
| W4-CH3-S2-1-CCS_07 | Zna matematykę wyższą w zakresie niezbędnym do zrozumienia i opisu procesów chemicznych.                        | CH_W05 | 4 |
| W4-CH3-S2-1-CCS_08 | Zna teoretyczne podstawy działania aparatury pomiarowej stosowanej w chemii ciała stałego.                      | CH_U02 | 3 |
| W4-CH3-S2-1-CCS_09 | Posiada ogólną wiedzę o aktualnych kierunkach rozwoju i najnowszych odkryciach w zakresie chemii ciała stałego. | CH_W01 | 3 |
| W4-CH3-S2-1-CCS_10 | Potrafi dobrać metodę i aparaturę do wykonania konkretnych badań z uwzględnieniem aspektów ekonomicznych.       | CH_U01 | 3 |
| W4-CH3-S2-1-CCS_11 | Umie rozwiązać problemy związane z budową, reaktywnością i wzajemnym oddziaływaniem molekuł.                    | CH_U02 | 3 |
| W4-CH3-S2-1-CCS_12 | Potrafi praktycznie zastosować poznane metody otrzymywania monokryształów.                                      | CH_U03 | 4 |

| 9. Methods of conducting classes |                                      |  |
|----------------------------------|--------------------------------------|--|
| Code                             | Category                             | Name (description)   |
| a01                              | Lecture methods / expository methods | Formal lecture/ course-related lecture<br><i>a systematic course of study involving a synthetic presentation of an academic discipline; its implementation assumes a passive reception of the information provided</i>   |
| a05                              | Lecture methods / expository methods | Explanation/clarification<br><i>explication involving the derivation of a predetermined theorem from other, already known ones, in the number of steps specified by the person teaching the course</i>   |
| b01                              | Problem-solving methods              | Problem-based lecture<br><i>an analysis of a selected scientific or practical problem accompanied by its assessment and an attempt to provide a solution to the issues presented in the lecture as well as the indication of the consequences of the proposed solution</i>   |
| b02                              | Problem-solving methods              | Lecture-discussion<br><i>transmission of content involving interaction with the lecture audience; discussion of lecture-related issues is one of its elements or constitutes its follow-up</i>   |
| b03                              | Problem-solving methods              | Activating method – educational games<br><i>learning content in the guise of a rule- and/or principle-based game; conducted in a deliberately arranged situation based on the description of relevant facts and processes; learners compete with one another within the framework of rules laid down by the academic teacher; varieties include simulation games – involving a simulation of real situations; decision games – based on the decision-making process and the recognition of the consequences of the decisions made (e.g., a decision tree); psychological games – increasing the emotional-volitional component of the participants' attitudes</i>  |
| b04                              | Problem-solving methods              | Activating method – discussion / debate<br><i>an exchange of views supported by substantive arguments leading to a clash of different views, a compromise or the identification of common positions; it proceeds according to previously agreed-upon rules regarding the time, manner and turn-taking as well as the principles of civil discourse; a discussion is not a competition but aims at finding the best solutions or presenting different points of view; its varieties include brainstorming, Oxford-style debate, panel discussion, decision tree, conference discussion; a debate is an orderly dispute between supporters and opponents of a viewpoint, usually specialists in the field or pre-selected representatives of a group dealing with a common problem</i> |
| c06                              | Demonstration methods                | Demonstration-imitation  |

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|     |                          | <i>a presentation of a model way of performing specific activities accompanied by a commentary; it aims at triggering imitation activities in an individual or in a group of participants observing the activities of the person teaching the course until the right habit is formed through regular exercise; the demonstration-imitation method is combined with a physical practice of activities/behaviours</i>                        |
| c07 | Demonstration methods    | Screen presentation<br><i>a presentation of synthetic image content using computer graphics, e.g., a series of slides or other multimedia forms, usually accompanied by a commentary; typical components of a screen presentation include text organized into bulleted points, charts, images and animations, sometimes sound effects or music; a multimedia illustration of course content presented in the form of a projected image</i> |
| f02 | Methods of self-learning | Individual work with a text<br><i>searching for and acquiring new information using textbooks and other written sources (including their digital versions); searching for texts, selecting fragments for analysis/interpretation, using other texts to solve a problem related to the studied issue</i>  |

**10. Forms of teaching**

| Code                | Name     | Number of hours | Assessment of the learning outcomes of the module | Learning outcomes of the module  | Methods of conducting classes |
|---------------------|----------|-----------------|---|--|-------------------------------|
| W4-CH-S2-1-CCS_fs_1 | lecture  | 15              | course work                                       | W4-CH3-S2-1-CCS_01, W4-CH3-S2-1-CCS_02, W4-CH3-S2-1-CCS_04, W4-CH3-S2-1-CCS_06   | a01, a05, b01, b02            |
| W4-CH-S2-1-CCS_fs_2 | workshop | 60              | course work                                       | W4-CH3-S2-1-CCS_02, W4-CH3-S2-1-CCS_03, W4-CH3-S2-1-CCS_05, W4-CH3-S2-1-CCS_06, W4-CH3-S2-1-CCS_07, W4-CH3-S2-1-CCS_08, W4-CH3-S2-1-CCS_09, W4-CH3-S2-1-CCS_10, W4-CH3-S2-1-CCS_11, W4-CH3-S2-1-CCS_12 | a05, b03, b04, c06, c07, f02  |

**11. The student's work, apart from participation in classes, includes in particular:**

| Code | Category                | Name (description)  | Is it part of the BUNA? |
|------|-------------------------|---|-------------------------|
| a01  | Preparation for classes | Search for materials and review activities necessary for class participation<br><i>reviewing literature, documentation, tools and materials as well as the specifics of the syllabus and the range of activities indicated in it as required for full participation in classes</i>                        | No                      |
| a02  | Preparation for classes | Literature reading / analysis of source materials<br><i>reading the literature indicated in the syllabus; reviewing, organizing, analyzing and selecting source materials to be used in class</i>   | No                      |
| a04  | Preparation for classes | Consulting materials complementary to those indicated in the syllabus<br><i>agreeing on materials complementary to those indicated in the syllabus, supporting the implementation of tasks resulting from or necessary for class participation</i>  | Yes                     |
| a05  | Preparation for classes | Production/preparation of tools, materials or documentation necessary for class participation<br><i>developing, preparing and assessing the usefulness of tools and materials (e.g. aids, scenarios, research tools, equipment, etc.) to be employed in class or as an aid when preparing for classes</i> | No                      |

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| b03 | Consulting the curriculum and the organization of classes | Consulting the schedule<br><i>getting acquainted with the class schedule, possibly in the presence of the year tutor, in order to optimize participation in classes, including those supplementary to the core subjects listed in the pursued study programme</i>   | Yes |
| c03 | Preparation for verification of learning outcomes         | Implementation of an individual or group assignment necessary for course/phase/<br>examination completion<br><i>a set of activities aimed at performing an assigned task, to be executed out of class, as an obligatory phase/element of the verification of the learning outcomes assigned to the course</i> | Yes |

Information on the details of the module implementation in a given academic year can be found in the syllabus available in the USOS system: <https://usosweb.us.edu.pl>.