

## Subject card

|                                             |                                                                                                              |                                                          |                                         |                                     |                        |            |     |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|------------------------|------------|-----|
| Subject name and code                       | Enzymes for environmental sustainability, PG_00179656                                                        |                                                          |                                         |                                     |                        |            |     |
| Field of study                              | Environmental Protection                                                                                     |                                                          |                                         |                                     |                        |            |     |
| Date of commencement of studies             | October 2026                                                                                                 |                                                          | Academic year of realisation of subject |                                     | 2027/2028              |            |     |
| Education level                             | Master's studies                                                                                             |                                                          | Subject group                           |                                     | Optional subject group |            |     |
| Mode of study                               | full-time studies                                                                                            |                                                          | Mode of delivery                        |                                     | at the university      |            |     |
| Year of study                               | 2                                                                                                            |                                                          | Language of instruction                 |                                     | Polish                 |            |     |
| Semester of study                           | 4                                                                                                            |                                                          | ECTS credits                            |                                     | 1.0                    |            |     |
| Learning profile                            | academic                                                                                                     |                                                          | Assessment form                         |                                     | credit                 |            |     |
| Conducting unit                             | Laboratory of Bioorganic Chemistry -> Department of Molecular Biochemistry -> Faculty of Chemistry -> Rector |                                                          |                                         |                                     |                        |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                           |                                                          | dr hab. Dawid Dębowski, prof. UG        |                                     |                        |            |     |
|                                             | Teachers                                                                                                     |                                                          |                                         |                                     |                        |            |     |
| Lesson types                                | Lesson type                                                                                                  | Lecture                                                  | Tutorial                                | Laboratory                          | Project                | Seminar    | SUM |
|                                             | Number of study hours                                                                                        | 15.0                                                     | 0.0                                     | 0.0                                 | 0.0                    | 0.0        | 15  |
|                                             | 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                                                                                        | 15                                                       |                                         | 2.0                                 |                        | 8.0        | 25  |
| Subject objectives                          | Understanding and learning the fundamental concepts and laws in the field of enzymology.                     |                                                          |                                         |                                     |                        |            |     |
|                                             | Becoming familiar with the structure, role, and mechanisms of action of selected classes of enzymes.         |                                                          |                                         |                                     |                        |            |     |
|                                             | Exploring examples of enzyme applications in environmental protection.                                       |                                                          |                                         |                                     |                        |            |     |

| Learning outcomes | Course outcome                                                                                                                                                                                                                                      | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                | Method of verification                       |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
|                   | [OŚMU2_K10] Has a need for continuous professional development.                                                                                                                                                                                     | Understands the need for continuous learning and updating of knowledge.<br><br>Is aware of the importance of critically analyzing one's own work and source data.                                                                                                                                                                                                                                              | [SK1] oral statement/conversation/discussion |
|                   | [OŚMU2_K01] Behaves in a professional manner at all times; bears full responsibility for the actions taken relating to the protection of the environment and respects the principles of professional ethics and principles of intellectual honesty. | Demonstrates the need for continuous professional development.<br><br>Identifies and resolves dilemmas related to assessing environmental exposure to pollutants, and understands the importance of ethical reflection.<br><br>Is aware of the risks associated with the emission of pollutants into the environment.                                                                                          | [SK1] oral statement/conversation/discussion |
|                   | [OŚMU2_K06] Recognises the importance of knowledge in solving encountered cognitive and practical problems and consults experts in the event of difficulties in solving a problem on her/his own.                                                   | Understands the need for continuous learning and updating of knowledge.<br><br>Demonstrates cautious critical thinking when accepting information, especially that available in mass media.                                                                                                                                                                                                                    | [SK1] oral statement/conversation/discussion |
|                   | [OŚMU2_W04] Chooses methods, techniques and research tools used in environmental protection.                                                                                                                                                        | Is familiar with the advantages and limitations of selected laboratory devices and techniques used to assess enzymatic activity.<br><br>Is familiar with the advantages and limitations of laboratory techniques used for enzyme immobilization.                                                                                                                                                               | [SW1] oral statement/conversation/discussion |
|                   | [OŚMU2_W05] Describes development directions and the latest discoveries in the field of scientific disciplines related to environmental protection.                                                                                                 | Knows the latest examples of enzyme applications in environmental protection.                                                                                                                                                                                                                                                                                                                                  | [SW1] oral statement/conversation/discussion |
|                   | [OŚMU2_U05] Searches, selects and analyses the literature achievements of environmental sciences, including scientific journals and databases, reading and understanding scientific texts in her/his native language and in English.                | Demonstrates the ability to locate and critically evaluate information from scientific literature.                                                                                                                                                                                                                                                                                                             | [SU1] oral statement/conversation/discussion |
|                   | [OŚMU2_W01] Describes complex phenomena and processes occurring in nature, including those related to the spread of anthropogenic pollution.                                                                                                        | Describes the structure of enzymes and their active sites, lists the basic functions and properties of enzymes. Explains the concept of enzymatic specificity using selected enzyme examples.<br><br>Describes the factors that influence the catalytic activity of enzymes.<br><br>Distinguishes and characterizes the basic types of enzymes.<br><br>Knows the methods of enzyme immobilization on carriers. | [SW1] oral statement/conversation/discussion |
|                   | [OŚMU2_U01] On the basis of the acquired knowledge, proposes to solve environmental problems.                                                                                                                                                       | Is aware of the usefulness of enzymes in environmental protection.<br><br>Knows examples of enzyme applications in environmental protection.<br><br>Knows the advantages and disadvantages of such solutions.                                                                                                                                                                                                  | [SU1] oral statement/conversation/discussion |

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|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Subject contents                                               | Basic concepts in enzymology.                                                                                          |                                                                                                                                                   |                               |
|                                                                | Basic classification of enzymes.                                                                                       |                                                                                                                                                   |                               |
|                                                                | Factors affecting enzyme activity.                                                                                     |                                                                                                                                                   |                               |
|                                                                | Enzyme immobilization.                                                                                                 |                                                                                                                                                   |                               |
|                                                                | Applications of enzymes in environmental protection (e.g. degradation of pharmaceutical compounds, synthetic plastics) |                                                                                                                                                   |                               |
| Prerequisites and co-requisites                                | Basic knowledge of organic chemistry.                                                                                  |                                                                                                                                                   |                               |
| Assessment methods and criteria                                | Subject passing criteria                                                                                               | Passing threshold                                                                                                                                 | Percentage of the final grade |
|                                                                | Oral presentation / conversation / discussion                                                                          | 0.0%                                                                                                                                              | 100.0%                        |
| Recommended reading                                            | Basic literature                                                                                                       | J. M. Berg, J. L. Tymoczko, L. Stryer, "Biochemistry", PWN, Warszawa 2009.<br>E. Bańkowski "Biochemistry", Elsevier Urban & Partner Wrocław 2004. |                               |
|                                                                | Supplementary literature                                                                                               | R.A. Copeland "Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis", 2nd Edition, Wiley                                  |                               |
|                                                                | eResources addresses                                                                                                   |                                                                                                                                                   |                               |
| Example issues/<br>example questions/<br>tasks being completed | Basic concepts in enzymology.                                                                                          |                                                                                                                                                   |                               |
|                                                                | Basic classification of enzymes.                                                                                       |                                                                                                                                                   |                               |
|                                                                | Factors affecting enzyme activity.                                                                                     |                                                                                                                                                   |                               |
|                                                                | Enzyme immobilization.                                                                                                 |                                                                                                                                                   |                               |
|                                                                | Applications of enzymes in environmental protection                                                                    |                                                                                                                                                   |                               |
| Work placement                                                 | Not applicable                                                                                                         |                                                                                                                                                   |                               |

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