



COURSE CARD

1. Basic information

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| Course name in English: | Technology of bioelectrochemical systems for sustainability | |
| Course name in Polish: | Technologia układów bioelektrochemicznych dla zrównoważonego rozwoju | |
| Number of hours: | 30 | |
| Type of course: | Elective course | |
| Form of course: | mixed forms (combination of lecture, seminar and laboratory) | |
| Code of course: | W03INC-SD0101W / CIQ100396W | |
| Course leader: | DR INŻ. GRZEGORZ PASTERNAK | |
| Faculty of the course leader: | W3 Faculty of Chemistry | |
| Email address of the course leader: | GRZEGORZ.PASTERNAK@PWR.EDU.PL | |
| Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course): | Architecture and urban planning | <input checked="" type="checkbox"/> |
| | Automation, electronic, and electrical engineering | <input checked="" type="checkbox"/> |
| | Information and communication technology | <input type="checkbox"/> |
| | Biomedical engineering | <input checked="" type="checkbox"/> |
| | Chemical engineering | <input checked="" type="checkbox"/> |
| | Civil engineering and transport | <input checked="" type="checkbox"/> |
| | Mechanical engineering | <input checked="" type="checkbox"/> |
| | Environmental engineering, mining, and energy | <input checked="" type="checkbox"/> |
| | Mathematics | <input type="checkbox"/> |
| | Chemical sciences | <input checked="" type="checkbox"/> |
| | Physical sciences | <input checked="" type="checkbox"/> |
| | Management and quality studies | <input type="checkbox"/> |

2. Objectives

Familiarising students with principles of bioelectrochemistry and introducing to wide range of bioelectrochemical methods applications.

3. Content

Detailed information about the course content, including topics and form of classes.

| No. | Topic | Number of hours | Form of classes |
|-----|--|-----------------|-----------------|
| 1 | Introduction to bioelectrochemical systems technology | 2 | lecture |
| 2 | Introduction to microbial growth and metabolism used in power generation | 4 | lecture |
| 3 | Principles of Microbial Fuel Cell (MFC) technology | 2 | lecture |
| 4 | R&D aspects of MFCs (methods, materials development) | 2 | lecture |



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| 5 | Designs and applications for electricity production | 2 | lecture |
| 6 | Sediment MFCs and electrochemical snorkels | 2 | lecture |
| 7 | Microbial Electrolysis Cells | 2 | lecture |
| 8 | Microbial Desalination Cells | 2 | lecture |
| 9 | Bioelectrosynthesis | 2 | lecture |
| 10 | Biosensors based on bioelectrochemical systems | 2 | lecture |
| 11 | Biofuel cell sensors | 2 | lecture |
| 12 | Trends, concepts and inspirations for implementing bioelectrochemical reactors | 2 | lecture |
| 13 | Crediting with grade | 4 | seminar |

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

Knowledge in chemistry. Basic knowledge in biology and physics.

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

| Symbol | Learning outcome | |
|--------|--|-------------------------------------|
| | <i>KNOWLEDGE. Doctoral student knows and understands:</i> | |
| SzD_W3 | the main trends in the development of the scientific or artistic disciplines covered in the curricula; | <input checked="" type="checkbox"/> |
| SzD_W4 | research methodology; | <input checked="" type="checkbox"/> |
| SzD_W5 | the rules for the dissemination of scientific results, including in open access mode; | <input checked="" type="checkbox"/> |
| SzD_W6 | the fundamental dilemmas of modern civilization; | <input type="checkbox"/> |
| SzD_W7 | the legal and ethical conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W8 | the economic and other relevant conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W9 | basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results. | <input type="checkbox"/> |
| | <i>SKILLS. Doctoral student is able to:</i> | |
| SzD_U2 | use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres; | <input checked="" type="checkbox"/> |



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| SzD_U3 | communicate on specialised topics to the extent that they enable an active participation in the international scientific community; | <input checked="" type="checkbox"/> |
| SzD_U4 | disseminate research results, including in popular forms; | <input checked="" type="checkbox"/> |
| SzD_U5 | initiate debates and participate in a scientific discourse; | <input type="checkbox"/> |
| SzD_U6 | be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment; | <input type="checkbox"/> |
| SzD_U7 | plan and implement an individual or collective research or creative activity, including in an international environment; | <input type="checkbox"/> |
| SzD_U8 | independently plan and act for one's own development and inspire and organize the development of others; | <input type="checkbox"/> |
| SzD_U9 | plan classes or groups of classes and implement them using modern methods and tools. | <input type="checkbox"/> |
| <i>SOCIAL COMPETENCES. Doctoral student is ready to:</i> | | |
| SzD_K3 | fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way; | <input type="checkbox"/> |
| SzD_K4 | maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection. | <input type="checkbox"/> |

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Presentation

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

Interactive presentation, literature studies, discussion

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

PRIMARY LITERATURE:

[1] Microbial Fuel Cells, Bruce E. Logan, 2007, DOI:10.1002/9780470258590

[2] Microbial Electrochemical and Fuel Cells, Fundamentals and Applications, Keith Scott and Eileen Hao Yu, 2016, DOI 10.1016/C2014-0-01767-4

SECONDARY LITERATURE:

[1] Prescott's Microbiology, Joanne Willey and Linda Sherwood and Christopher J. Woolverton, 10th edition, 2017. (also earlier)



9. Other remarks

Additional remarks, comments, (e.g., language of the course)

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