COURSE DESCRIPTION CARD - SYLLABUS

Course name
MODIFICATION OF ELECTRODES WITH ELECTROACTIVE MATERIALS POSSESSING REDOX PROPERTIES FOR APPLICATIONS IN ENZYMATIC BIOSENSORS AND ELECTROCHEMICAL DETECTION. [S5NC>MEEM]

Course

Proposed by Discipline
–

Year/Semester
2/3

Level of study
Doctoral School

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
4

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

dr hab. inż. Tomasz Rębiś
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Prerequisites

Basic knowledge in chemistry and electrochemistry.

Course objective

The aim of the course is to introduce students to methods of electrode modification with electroactive materials exhibiting redox properties, and to provide an understanding of their role in the design and operation of enzymatic biosensors as well as in advanced electrochemical detection techniques.

Course-related learning outcomes

Describe the mechanisms of redox processes relevant for biosensors and electrochemical detection.
Identify suitable materials and methods for electrode functionalization in enzymatic biosensors.
Design simple electrochemical sensing systems based on redox-active materials.
Analyze and interpret experimental electrochemical data.

KNOWLEDGE (W)
scientific research methodology in disciplines represented at the Doctoral School P8S_WG, SzD_W03

SKILLS (U)
critically analyze and assess scientific research results, work of experts and other creative activities together with their contribution into knowledge development, P8S_UW, SzD_U01
share results of scientific activity also in a popular form P8S_UK, SzD_U05

SOCIAL COMPETENCIES (K)
critically evaluate their own contribution to development of a given scientific discipline, P8S_KK, SzD_K01

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Traditional form of assessment after the lecture as well as
assessment of active participation in classes and discussions.

Programme content

The classes focus on the design and modification of electrodes with redox-active materials, their electrochemical characterization, and applications in biosensing. Students will learn about nanocarbon-based materials, redox mediators, and enzymatic systems, as well as the principles of electrochemical detection and the practical aspects of constructing biosensors.

Course topics

Fundamentals of electrode materials and their electrochemical properties.

Methods of electrode modification with electroactive compounds.

Redox-active molecules and their role in electron transfer processes.

Characterization of modified electrodes using electrochemical techniques (CV, DPV, EIS).

Principles of enzymatic biosensors: immobilization strategies, electron mediation, signal transduction.

Applications of modified electrodes in electrochemical detection of biologically relevant compounds.

Case studies of nanocarbon-based materials in sensing and biosensing.

Teaching methods

Lectures supported by multimedia presentations.
Group discussions and case studies on biosensor design.

Bibliography

Basic:
Richard G Compton, Craig E Banks, Understanding Voltammetry, 2nd Edition, World Scientific Publishing, 2010
Allen J. Bard, Larry R. Faulkner, Henry S. White, Electrochemical Methods Fundamentals and Applications, Wiley 2006
Additional:
Joseph Wang, Analytical Electrochemistry, Fourth Edition, John Wiley and Sons Ltd, 2023

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	4	0,00
Doctoral student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation)	21	1,00