COURSE DESCRIPTION CARD - SYLLABUS

Course name

Electrochemical engineering

Course

Field of study

Chemical and process engineering

Year/Semester

1/1

Area of study (specialization)

Bioprocesses and biomaterials engineering

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

PhD, DSc, Eng. Grzegorz Lota, Associate Professor

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tel. 61 666 21 58,-59

Faculty of Chemical Technology

ul. Berdychowo 4, 60-965 Poznań

Responsible for the course/lecturer:

PhD, DSc, Eng.Jarosław Wojciechowski

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Faculty of Chemical Technology

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Prerequisites

The student has a basic knowledge of chemistry, physics and mathematics acquired from the first degree of study in the fields of chemical technology, environmental protection technologies, chemical and process engineering, pharmaceutical engineering or other related fields.

The student has mastered the ability to independently perform laboratory experiments in the field of inorganic, organic, physical, analytical chemistry, chemical technology and chemical engineering.

The student is aware of the limitations of their own knowledge and understands the need for further improvement (further training).

Course objective

The aim of the course is to provide students the knowledge of chemical engineering involving electrochemical processes and to master the skills of conducting laboratory experiments using electrical energy.

Course-related learning outcomes

Knowledge

1. Has expanded and in-depth knowledge in the field of electrochemistry and other related areas of science, allowing to formulate and solve complex tasks related to electrochemical engineering. [K_W2]

2. Has knowledge of complex electrochemical processes, including the appropriate selection of materials, raw materials, methods, techniques, apparatus and equipment for the implementation of electrochemical processes and characterization of the obtained products. [K_W3]

3. Has extended knowledge in the field of kinetics, thermodynamics and surface phenomena of electrochemical processes. [K_W4]

4. Has expanded knowledge of the latest electrochemical and material technologies, including advanced materials and nanomaterials technologies, knows current trends in the development of electrochemical industrial processes. [K_W6]

5. Knows modern methods of electrochemical research, necessary to characterize raw materials and products of the chemical, electrochemical and related industries. [K_W7]

6. Has solid knowledge in the field of occupational safety and health. [K_W10]

7. Has extended knowledge of advanced devices and apparatus used in electrochemical engineering. [K_W13]

Skills

1. Has the ability to obtain and critically evaluate information from literature, databases and other sources, and formulate opinions and reports on this basis. [K_U1]

2. Has the ability to communicate with specialists and non-specialists in the field of electrochemical engineering and related fields. [K_U4]

3. Is able to independently determine the directions of further education and implement self-education. [K_U5]

4. Has the ability to professionally present research results in the form of a report or presentation. [K_U6]

5. Is able to use professional software, using them to design electrochemical processes. [K_U7]

6. Uses advanced computer programs to support the implementation of tasks typical to electrochemical engineering, plans electrochemical experiments and examines their course and properly interprets the obtained results. [K_U8]

7. Is able to design and conduct electrochemical processes on a laboratory scale in various conditions and properly use the results of these tests to scale up. [K_U9]

8. Has extended skills to analyze and solve problems related to electrochemical engineering, using theoretical, experimental and simulation methods for this purpose. [K_U10]

9. Is able to properly verify the concepts of engineering solutions in relation to the state of the art in electrochemical technology and electrochemical engineering. [K_U11]

10. Has the ability to adapt knowledge in the field of electrochemistry and related to solve problems in the field of electrochemical engineering and planning new industrial processes. [K_U12]

11. Is able to properly formulate and verify hypotheses related to engineering problems in electrochemical engineering. [K_U14]

12. Is able to critically analyze industrial electrochemical processes and introduce modifications and improvements in this area, using the acquired knowledge, including knowledge about the latest achievements of science and technology. [K_U15]

13. Is able to critically assess the practical usefulness of using new achievements in electrochemical engineering. [K_U17]

14. Has the skills necessary to work in an industrial environment and in research teams. [K_U18]

15. Knows and obeys the safety rules related to the performed work. [K_U19]

16. Is able to critically evaluate the results of experimental research and determine the direction of further research leading to solving problems in the field of electrochemistry. [K_U21]

17. Has the ability to use the knowledge acquired under the specialty course in professional activity. [K_U23]

18. Is able to design a complex device or process in the field of electrochemical technology and electrochemical engineering. [K_U24]

Social competences

1. Is aware of the need for lifelong learning and professional development. [K_K1]

2. Is aware of the limitations of science and technology related to electrochemical engineering, including environmental protection. [K_K2]

3. Professionally recognizes problems and makes the right choices related to the profession, in accordance with the principles of ethics. [K_K3]

4. Adheres to all teamwork rules; is aware of the responsibility for joint ventures and achievements in professional work. [K_K4]

5. Represents a high moral level in relation to social and professional problems. [K_K5]

6. Can think and act in a creative way. [K_K6]

7. Understands the need to provide the public with information on the current state and directions of development of electrochemical engineering, on the principles of use and handling of products of electrochemical processes, about the risks associated with the acquisition and distribution of raw materials in the electrochemical industry. [K_K7]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Ongoing control of knowledge and skills during laboratory exercises.

2. Assessment of oral and written answers on issues related to the laboratory exercise.

3. Written final exam.

Programme content

1. Introduction to "electrochemical engineering" subject.

2. The specificity of electrochemical processes.

3. The rate of electrode processes.

4. Mechanism and kinetics of electrode processes.

5. The role of mass transport in the electrode process.

6. Electrochemical reactors.

7. Engineering solutions in implementing the principle of best use of potential differences in electrochemical industrial processes.

8. Engineering solutions in implementing the principle of the best use of raw materials in electrochemical industrial processes.

9. Engineering solutions in implementing the principle of best use of energy in electrochemical industrial processes.

10. Engineering solutions in implementing the principle of the best use of apparatus in electrochemical industrial processes.

11. Chemical power sources: operating principle, construction, operating characteristics.

Teaching methods

1. Supply methods (lectures).

2. Practical methods (laboratory exercises).

Bibliography

Basic

1. A. Ciszewski, Podstawy inżynierii elektrochemicznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.

2. A. Ciszewski, Wybrane zagadnienia inżynierii elektrochemicznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2011.

Additional

3. A. Czerwiński, Akumulatory, bateria, ogniwa, WKŁ, Warszawa 2005.

4. H. Sholl, T. Błaszczyk, P. Krzyczmonik, Elektrochemia. Zarys teorii i praktyki, Wydawnictwo Uniwersytetu Łódzkiego, Łódź 1998.

5. A. Kisza, Elektrochemia. Tom I: Jonika, WNT, Warszawa 2000.

6. A. Kisza, Elektrochemia. Tom II: Elektrodyka, WNT, Warszawa 2000.

7. H. Bala, Korozja materiałów – teoria i praktyka, WIPMiFS, Częstochowa 2000.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	60	
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam) [1]	30	

[1] delete or add other activities as appropriate