STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Electrochemical Engineering		**1010702111010710356**
Field of study: **Chemical and Process Engineering**	Profile of study (general academic, practical): **(brak)**	Year /Semester: **1 / 1**
Elective path/specialty: **Bioprocesses and Biomaterials Engineering**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time): **full-time**	
No. of hours: Lecture: **2** Classes: **-** Laboratory: **2** Project/seminars: **-**		No. of credits: **3**
Status of the course in the study program (Basic, major, other): **(brak)**	(university-wide, from another field): **(brak)**	
Education areas and fields of science and art		ECTS distribution (number and %)

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student has a basic knowledge of physical chemistry, inorganic chemistry and electrochemistry. Student knows the mathematical tools used in the chemical calculation.
2	**Skills**	Student uses basic laboratory techniques. Student has the ability to present research results in the form of a report .
3	**Social competencies**	Student understands the need for further education and improving the personal competences.

Assumptions and objectives of the course:

The aim of the course is enable students to get the knowledge of chemical engineering involving electrochemical processes and skills of the laboratory experiments using electricity.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student has knowledge of the basis of electrochemical processes used in the industry - [[KW_02]]
2. Student has knowledge of chemical processes using electricity, including their kinetics, selection of materials, methods, techniques, apparatus and equipment for their implementation - [[K_W03, K_W04, K_W07, K_W09]]
3. Student has a knowledge of the methods for testing the electrode material?s properties used in electrochemical systems, i.e. in the electrochemical capacitors, fuel cells, electrolyzers, etc. - [[K-W08]]
4. Student has knowledge of technological moderation and quality management of obtained products in the electrochemical processes - [[K-W10]]

Skills:

1. Student has the ability to design and control the electrochemical processes, is able to select suitable electrode materials, electrolytes and operating parameters of the electrochemical apparatus - [[K_U09, K_U11, K_U12, K_U13, K_U14]]
2. Student is able to critically evaluate the obtained results, presents them in the form of a report and defines further studies - [[K-U06, K-U18]]
3. Student can study electrochemical reactions on a laboratory scale in different conditions and implements the results to a larger scale - [[K_U08]]

Social competencies:

1. Student understands the need for further education and improving the personal competences - [[K_K01]]
2. Student is aware of the principles of engineering ethics - [[K_K05]]
3. Student has an awareness of the need to protect the environment - [[K_K02]]
4. Student can cooperate and work in a group, taking different roles - [[K_K03]]

Assessment methods of study outcomes

1. Current control of knowledge and skill during laboratory exercises.
2. Evaluation of oral answers in the field of laboratory exercises.
3. A written final exam.

Course description

1. Introduction to the course "Electrochemical Engineering".
2. The specificity of the electrochemical processes.
3. The rate of electrode processes.
4. The mechanism and kinetics of electrode processes.
5. The role of the mass transport in the electrode.
6. Electrochemical reactors.
7. Engineering solutions in the implementation of the principle of the best use of electrochemical potential differences in industrial processes.
8. Engineering solutions in the implementation of the principle of the best use of raw materials in electrochemical industrial processes.
9. Engineering solutions in the implementation of the principle of the best use of energy in industrial processes, electrochemical
10. Engineering solutions in the implementation of the principle of the best use of electrochemical devices in industrial processes.
11. Chemical power sources, the principle of operation, construction, design, operating characteristics.

Basic bibliography:

1. A. Ciszewski, Podstawy inżynierii elektrochemicznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.
2. A. Ciszewski, Wybrane zagadnienia inżynierii elektrochemicznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2011.

Additional bibliography:

1. G. Prentice, Electrochemical Engineering Principles, Prentice Hall International Series in the Physical and Chemical Sciences, Prentice Hall, Upper Saddle River, NJ 07458, New York 1991.
2. H. Wendt, G. Kreysa, Electrochemical Engineering, Science and Technology in Chemical and Other Industries, Springer-Verlag Berlin Heidelberg 1999.

Result of average student's workload

Activity	Time (working hours)
1. Lecture	30
2. Consultation to the lecture	4
3. Consultation to the laboratory	4
4. Preparation to the laboratory	10
5. Laboratory	30
6. Exam preparation	10
7. Exam	2

Student's workload

Source of workload	hours	ECTS
Total workload	90	3
Contact hours	70	0
Practical activities	30	0