STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Dynamics of Processes		**1010702221010700642**
Field of study: **Chemical Technology**	Profile of study (general academic, practical): **general academic**	Year /Semester: **1 / 2**
Elective path/specialty: **Indrustrial Electrochemistry**	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: **-** Classes: **-** Laboratory: **-** Project/seminars: **30**		No. of credits: **2**
Status of the course in the study program (Basic, major, other): **other**	(university-wide, from another field): **university-wide**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **2 100%** **2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The student should have a basic knowledge of technical electrochemistry, in particular concerning electrode processes and electrochemical polarization.
2	**Skills**	The student should be able to pursue self-directed learning
3	**Social competencies**	The student should understand the need for further self-learning and the learning of others (students)

Assumptions and objectives of the course:

Mastering the principles of preparing mathematical and graphical description of electrochemical engineering processes as a basis for determining the model capable of analyzing the behavior of the system and the development of rules controlling it at standard conditions, and automatically adjust in response to the presence of interference.

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

Knowledge:

1. The student has a broader and deeper knowledge of mathematics and computer science necessary for modeling, planning, optimization and characterization of industrial chemical processes.- - [K_W01]
2. The student has a broader and deeper knowledge of chemistry and other related fields of science, allowing the formulation and solving complex tasks associated with chemical technology. - [K_W02]

Skills:

1. The student is able to use professional software, used for modeling electrochemical processes.-[- [K_U07]
2. The student has extended ability to analyze and solve problems related to chemical technology and engineering processes, using for this purpose the theoretical, experimental and simulation methods - [K_U10]

Social competencies:

1. Student has formed awareness of the limitations of science and technology related to chemical technology, including environmental - [K_K02]
2. The student is able to properly identify priorities for implementation specified by himself or other tasks - [K_K04]
3. The student is able to think and act in a creative and enterprising - [K_K06]

Assessment methods of study outcomes

Forming Evaluation: Written test of skills description in mathematical and graphical form of static and dynamic properties of simple processes in the field of electrochemical technology. The test covers the tasks with assigned the number of points. The test is passed after obtaining more than 50% of the points.

Summary Evaluation: Evaluation individually made project of the specified electrochemical process modelling involving evaluation of the written test (share 20%).

Course description

The seminars are designed to provide knowledge on modeling using analytical method objects / processes, involving the preparation of the mathematical description of static and dynamic properties of the real system under consideration allows the analysis of the behavior of the process / object in different conditions, and the development principles of control or automatic regulation. Practical preparation and the use of mathematical description for simulation and analysis of electrochemical processes occurring in the conditions:

1) chronoamoperometry (Cottrell equation) for the linear, spherical and semispherical diffusion (employing ultramicroelectrods and disk electrodes);

2) chronocoulometry and double potential step chronocoulometry, with influence of the electrical double layer;

3) linear potential sweep chronoamperometry - including cyclic voltammetry (Randles - Sevcik equation) for reversible, quasireversible and irreversible processes regarding depolarizer and / or products adsorption conditions;

4) hydrodynamic: the rotating disk electrode (Koutecky-Levich equation), the tubular type, the channel type and the wall-jet type electrodes.

Basic bibliography:

1. F. Goodridge, K. Scott. Electrochemical Process Engineering. A guide to the Design of Electrolytic Plant. ? 1995 Plenum Press, New York. ISBN 0-36-44794-0.

2. G.S. Fishman. Symulacja komputerowa : pojęcia i metody. Państw. Wyd. Ekonomiczne, Warszawa 1981.

3. A.L. Bard, L.R. Faulkner. Electrochemical Methods. Fundamentals and Applications. 2nd ed. (Copyright ? 2001 by John Willey & Sons, INC.) ISBN 0-471-04372-9

4. B.W. Rossiter, J.F. Hamilton. Physical Methods of Chemistry. 2nd ed. Vol. II Electrochemical Methods. (Copyright ? 1986 by John Willey & Sons, INC.) ISBN 0-471-08027-6.

5. P. Monk. Fundamentals of Electroanalytical Chemistry. (Copyright ? 2001 by John Willey & Sons, Ltd.). ISBN 0-471-88036-1.

6. A. Kisza. Elektrochemia. Tom I: Jonika. WNT Warszawa 2000 (ISBN 83-204-2545-7)

7. A. Kisza. Elektrochemia. Tom II: Elektrodyka. WNT Warszawa 2000 (ISBN 83-204-2545-6)

Additional bibliography:

1. R. Zdanowicz. Modelowanie i symulacja procesów wytwarzania. Wyd. Politechniki Śląskiej, Gliwice 2002.

2. W. Tarnowski. Modelowanie systemów. Wyd. Uczelniane Politechniki Koszalińskiej, Koszalin 2004. ISBN 83-7365-052-0

3. W. Gierulski. Modelowanie i symulacja komputerowa: laboratorium (praca zbiorowa). Wyd. Politechniki Świętokrzyskiej, Kielce 1996.

4. A. Ciszewski. Podstawy inżynierii elektrochemicznej. Wydawnictwo Politechniki Poznańskiej, Poznań 2004 (ISBN 83-7143-384-0)

5. R. Dylewski, W. Gnot, M. Gonet. Elektrochemia przemysłowa. Wybrane procesy i zagadnienia. Wydawnictwo Politechniki Śląskiej, Gliwice 1999 (Skrypt Nr 2172)

Result of average student's workload

Activity	Time (working hours)
1. Seminar familiarizing with the principles of modeling of technological processes	30
2. Consultation related to the project	4
3. Preparation for written test	7
4. Modeling a given electrochemical process- design	15

Student's workload

Source of workload	hours	ECTS
Total workload	56	2
Contact hours	34	0
Practical activities	0	0