### **COURSE OFFERED**

Name of the	Polish	Nowoczesne metody chemii analitycznej
course	English	Modern Methods in Analytical Chemistry

### 1. LOCATION OF THE COURSE OF STUDY WITHIN THE EDUCATION SYSTEM

1.1. Section <sup>1</sup>	Section of Exact and Natural Sciences
1.2. Discipline <sup>2</sup>	Chemical Sciences
1.3. Type of education	Stationary
1.4. Level of education	Doctoral School
1.5. Person preparing the course description	dr hab. Sławomir Michałkiewicz prof UJK
1.6. Contact	slawomir.michalkiewicz@ujk.edu.pl

#### 2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Type of course <sup>3</sup>	specialized subjects in the discipline
2.2. Language of the course	English

### 3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Type of class	sses <sup>4</sup>	Laboratory						
3.2. The numbe	r of hours <sup>5</sup>	15						
3.3. Location of	classes	Classes in the laboratory of the Institute of Chemistry, UJK						
3.4. Type of ass	essment	pass with grade						
3.5. Didactic me	ethods	practical exercises						
3.6. Literature	supplementary	<ol> <li>F. Scholz, Electroanalytical Methods, Springer, Berlin Heidelberg, 2010.</li> <li>Z. Galus, fundamentals of Electrochemical Analysis, Ellis Horwood, New York 1994.</li> <li>J. Wang, Analytical Electrochemistry, Wiley-VCH, New York 2000.</li> <li>D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Podstawy chemii analitycznej, tom II, PWN, Warszawa 2007 (in polish).</li> <li>Instrumentalne metody analizy chemicznej, red. W. Kubiak, J. Gołaś, skrypt AGH w Krakowie, Wyd. Naukowe AKAPIT, Kraków 2005 (in polish).</li> <li>A. Cygański, Podstawy metod elektroanalitycznych, Wydawnictwo Naukowo-Techniczne, Warszawa 1999 (in polish).</li> </ol>						

# 4. OBJECTIVES, SYLLABUS CONTENT AND INTENDEND LEARNING OUTCOMES

# 4.1 Course objectives (including the form of classes)

CO1. Deepening knowledge of the theoretical foundations of electrode processes: analyte transport, electrode reactions, equipment and voltammetric techniques used in chemical electroanalysis.

CO2. Preparation for practical solution of chemical problems using voltammetric techniques.

<sup>&</sup>lt;sup>1</sup> Section of Humanities:, Social Sciences, Section of Exact and Natural Sciences, Section of Medical and Health Sciences, Section of Arts.

<sup>&</sup>lt;sup>2</sup> History, Linguistics, Literary Studies, Medical Sciences, Health Sciences, Political and Administrative Sciences, Legal Sciences, Security Sciences, Pedagogy, Communication and Media Studies, Management and Quality Studies, Biological Sciences, Chemical Sciences, Physical Sciences, Earth and related Environmental Sciences, Visual Arts and Artwork Conservation, Musical Arts.

<sup>&</sup>lt;sup>3</sup> General courses, domain specific subjects in the section, disciplinary subjects in the sections, specialized subjects in the discipline.

<sup>&</sup>lt;sup>4</sup> Classes, lecture, seminar.

<sup>&</sup>lt;sup>5</sup> Consistent with the education program at the Doctoral School Jan Kochanowski University in Kielce.

CO3. Familiarization with the electroanalytical procedure for the qualitative and quantitative analysis of a selected component of a pharmaceutical or cosmetic preparation using microelectrodes and an anhydrous environment.

### 4.2 Syllabus content

Voltammetry using microelectrodes. Properties and applications of voltammetric microelectrodes. Apparatus used in chemical electroanalysis. Construction of a voltammetric cell: working, auxiliary and reference electrodes. Characteristics of electrode materials and principles of their selection. Composition of solutions for voltammetric studies. Pulse techniques — optimization of measurement conditions. Interpretation of curves and determination of basic parameters characterizing the electrode process. Determination of the actual radius of microelectrodes. Analytical application of voltammetry on microelectrodes to identify and mark a selected component in a pharmaceutical or cosmetic preparation using the multiple addition of a standard method. Statistical analysis of results.

## 5. SUBJECT LEARNING OUTCOMES

Learning outcomes	A doctoral student who has passed the subject:  in the area of KNOWLEDGE:	Reference to thelearning outcomes of Doctoral School (according to the training program at the Doctoral School)							
W01	W01 The doctoral student knows modern electroanalytical techniques, including voltammetry using microelectrodes and the principles of their selection for solving analytical problems								
W02	The doctoral student has advanced knowledge of the directions of development of modern chemical electroanalysis.	SD_W02							
W03	The doctoral student formulates problems in the field of chemical electroanalysis and proposes ways to solve them	SD_W07							
	in the area of SKILLS:								
U01	The doctoral student is able to define the research objective, select an electroanalytical method to solve an analytical problem, validate it and assess the reliability of the results	SD_U01							
U02	The doctoral student is able to use knowledge from various sources to solve analytical problems	SD_U03							
U03	The doctoral student is able to use English-language literature in laboratory work.	SD_U07							
	in the area of SOCIAL COMPETENCE:								
K01	The doctoral student is able to think in a way that allows him to solve analytical problems and work actively in the laboratory	SD_K04							

### 6. METHODS OF ASSESSMENT OF THE INTENDED LEARNING OUTCOMES

		METHOD OF ASSESSMENT (+/-)																			
SUBJECT	Oral/writte n exam			Ко	Kolokwiu m		Project			activity in class			Own work		Group work		Others/ written report				
LEARNING OUTCOMES		The type of classes			The type of classes			The type of classes			The type of classes			The type of classes			The type of classes			The type of classes	
	L	С	S	L	С	S	L	С	S	L	С	S	L	С	S	L	С	S	L	С	S
W01											+									+	
W02											+										

W03						+					+	
U01						+					+	
U02						+					+	
U03						+					+	ĺ
K01						+					+	

# 7. CRITERIA OF ASSESSMENT OF THE INTENDED LEARNING OUTCOMES

Form of classes	Grade	Criterrion of assessment
9	3,0	56-64% of possible points in the areas of knowledge, skills and social competences
(L)	3,5	65-73% of possible points in the areas of knowledge, skills and social competences
ıre	4,0	74-82% of possible points in the areas of knowledge, skills and social competences
ecture.	4,5	83-91% of possible points in the areas of knowledge, skills and social competences
Ľ	5,0	92-100% of possible points in the areas of knowledge, skills and social competences

Accepted for execution		

<sup>&</sup>lt;sup>6</sup> Niepotrzebne usunąć.