

<b>Course title</b> Wykład dyplomowy - Nowoczesne techniki analizy środowiska/Diploma lecture - Modern technologies in environmental analysis		<b>ECTS code</b> 13.3.0598
<b>Name of unit administrating study</b>  <b>Faculty of chemistry</b>		
<b>Studies</b>		
<b>Field of study</b>	<b>Type</b>	<b>Form</b>
Chemistry	Bachelor	Full-time studies
<b>Teaching staff</b> Dr Łukasz Haliński		
<b>Forms of classes, the realization and number of hours</b>		<b>ECTS credits</b>
<b>A. Forms of classes, in accordance with the UG Rector's regulations</b> lecture		classes 30 h tutorial classes 5 h student's own work 15 h TOTAL: 50 h - 2 ECTS
<b>B. The realization of activities</b> In-class learning		
<b>C. Number of hours</b> Lecture 30 h		
<b>The academic cycle</b> Third year, summer semester		
<b>Type of course</b> obligatory	<b>Language of instruction</b> Polish	
<b>Teaching methods</b>  Lectures including multimodal presentation	<b>Form and method of assessment and basic criteria for evaluation or examination requirements</b>	
	<b>A. Final evaluation, in accordance with the UG study regulations</b> Course completion (with a grade)	
	<b>B. Assessment methods</b>  Lectures – test with open and closed questions	
	<b>The basic criteria for evaluation</b> Lecture: • pass the test with open and closed questions concerning the whole course content 91-100%: 5.0 81-90%: 4.5 71-80%: 4.0 61-70%: 3.5 51-60%: 3.0 Less than 51% 2.0	
<b>Required courses and introductory requirements</b>		
<b>A. Formal requirements</b> Basic chemistry, organic chemistry, inorganic chemistry, analytical chemistry, physical chemistry.		
<b>B. Prerequisites</b> Skills in basic chemistry, organic chemistry and physical chemistry. Basic knowledge on methods used in the chemical analysis.		
<b>Aims of education</b>		

- To provide students a clear understanding of the most important issues in modern chemical analysis of environmental pollutants
- To familiarize students with the basic knowledge on environmental pollution and pollutants
- To familiarize students with main stages of the analytical procedures
- To introduce students to principles of designing the analytical process basing on the structure and properties of the substance
- To learn students how to independently design simple analytical process

#### Course contents

The course includes principles of the modern environmental analysis. Specified topics of lectures are given below.

Classification of selected environmental pollutants, their sources and environmental fate. Selected physiochemical properties of compounds emitted to the environment. Main stages of the analytical process. Designing the analytical process basing on the structure and properties of chemicals. Extraction of pollutants from selected environmental matrices. Purification and separation of analytes. Chromatographic and spectroscopic techniques in determination of environmental pollutants. Examples of the whole analytical process: pesticides and petroleum-derived organic compounds.

#### Bibliography of literature

##### Literature required to pass the course

#### A. Literatura wymagana do ostatecznego zaliczenia zajęć (zdania egzaminu):

##### A.1. Literature used during classes:

Stepnowski P., Synak E., Szafranek B., Kaczyński Z. Techniki separacyjne. Wydawnictwo UG 2010.  
Witkiewicz Z. Podstawy chromatografii, Wydawnictwa Naukowo-Techniczne, Warszawa, 2005.

##### A.2. Literature form individual studies:

Stepnowski P., Synak E., Szafranek B., Kaczyński Z. Techniki separacyjne. Wydawnictwo UG 2010.  
Witkiewicz Z. Podstawy chromatografii, Wydawnictwa Naukowo-Techniczne, Warszawa, 2005.  
Szczepaniak W. Metody instrumentalne w analizie chemicznej, Wydawnictwo Naukowe PWN, Warszawa, 2002.

##### B. Extracurricular readings

Alloway B.J., Ayres D.C. Chemiczne podstawy zanieczyszczenia środowiska, PWN, Warszawa, 1999.  
Van Loon G.W., Duffy S.J. Chemia środowiska, PWN, Warszawa, 2008.  
Namieśnik i in. Przygotowanie próbek środowiskowych do analizy, WNT, W-wa, 2000.  
Johnstone R.A.W., Rose M.E. Spektrometria mas. Podręcznik dla chemików i biochemików. PWN, Warszawa, 2001.

#### Knowledge

1. Students know main sources of selected pollutants and understand importance of structure-activity relationship of a substance in determining its environmental fate.
2. Students are able to describe main stages of the analytical process and is familiar with principles of its design.
3. Students know selected modern methods of extraction, purification and chemical analysis of organic pollutants.
4. Students are able to define possibilities and limitations of basic analytical methods.

5. Students understand the importance of chemical structure and physicochemical properties of substances in choosing the most useful analytical technique for their determination.

#### **Skills**

1. Students are able to design simple analytical process basing on properties of the analyte.
2. Students are able to find and verify the data in different sources.
3. Students perform the critical review of analytical methods described in literature and estimate their usefulness in independently performed experiments.
4. Students are able to discuss topics associated with environmental pollution, using clear language and correct nomenclature.

#### **Social competence**

1. Students understand the need of life-long learning in environmental pollution-related topics.
2. Students are able to estimate the impact of human activity on natural environment in a conscious way.
3. Students tend to verify data found in popular and scientific literature in a critical way.
4. Students promote the importance of mathematics in describing phenomenons and processes.