Course Syllabus

I. General Information

Course name in English	Analysis of environmental samples
Course name in Polish	Analiza próbek środowiskowych
Programme	Bioanalytical technologies
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	MSc
Form of studies (full-time, part-time)	Full-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator/person responsible	Asst. Prof. Dr Anna Szafranek-Nakonieczna/

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS
Lecture	30	III	6
Tutorial			
Classes	30	III	
laboratory classes			
Workshops			
Seminar			
introductory seminar			
foreign language clas-ses			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	The basic knowledge of general-, inorganic-, organic chemistry, and physics. Ability to work in laboratory according to OHS rules.

II. Course Objectives

C1 – Acquainting of students with contemporary methods of instrumental analysis and their applica-tion in investigation of environmental samples.
C2 - Acquiring by students the basic knowledge for sampling, preservation and preparation of envi-ronmental samples.
C3 - Acquiring the skills for analysis of selected physical and chemical properties which are used for investigation/characterization of different kind of samples.

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
	KNOWLEDGE	
W_01	The student demonstrates the basic knowledge necessary to understand and explain the basic physical and chemical phenomena being the base of analytical methods use in environmental samples investigation.	K_W01
W_02	Student raises awareness about importance of investigation environmental threats. Student pays more attention to the importance of environmental monitoring.	K_W02
W_03	The student has knowledge of analytical methods and their application in the study of environmental samples.	K_W05
W_04	The student has knowledge of the principles of safe work in the analytical laboratory,	K_W07
	SKILLS	
U_01	Student can plan analytical procedures. Student points out the most crucial steps of discussed analytical process. Student can choose suitable sample preparation techniques for solid, aquatic and gaseous environmental samples.	K_U01, K_U15, K_U18
U_02	On the basis of the analyses carried out, the student prepares written reports using scientific terms and concepts in the field of analytical methods and conducts a discussion of the results obtained.	K_U06, K_U14
U_03	The student uses statistical methods and information technology to describe, interpret and develop the results obtained on the basis of analyses.	K_U04
U_04	The student learns independently in a targeted manner in the field of analytical methods used in environmental analysis, analyzes and updates knowledge and skills regarding the applicability and usefulness of analytical techniques.	K_U17
U_05	The student upgrades his ability to work in groups, shares responsibilities between group members, sets the rules of cooperation.	K_U19
	COMPETENCIES	
K_01	The student shows the habits necessary to work in a research laboratory in accordance with the principles of health and safety at work, shows care for the workplace, entrusted equipment and readiness to work in a group.	K_K05

IV. **Course Content**

Lecture:

1: Introduction to analysis of environmental samples

2: Fundamentals of environmental sampling /Techniques for sampling various environmental samples. Collecting and protection of research material (air, liquid, solid and plant samples)

3: Sample preservation and preparation for analysis (drying, freeze drying, sieving, milling, extraction, mineralization, filtration, dilution).

4: Classic and instrumental methods use for sample investigation. Type of errors and ways of their avoiding

5:Quantitative and qualitative analysis, ways of calibration of measuring systems.

6: Potentiometric methods application in environmental analysis (pH, Eh).

7: Salinity in environment, consequence and methods of determination.

8: Oxygen function and methods of determination in solid and liquid samples.

9: Basic concepts, laws on which the spectrophotometric methods are based and their use in environmental samples investigation (UV-VIS).

10: Colorimetric methods, laws, definition and applications.

11: Atomic absorption spectroscopy (ASA), macro- and microelements investigation in environment.

12: Carbon forms in environment and methods for their determination.

13: Principles of chromatographic methods, investigation of gaseous component/pollutants in environment

14: Development of environmental analysis and monitoring methods

15: Review and summary of lectures and preparations for final exam

Lab classes:

Classes 1: Lab OHS and general requirements

Classes 2: Preparation of solid and liquid samples for laboratory analysis (e.g. extraction, mineralization, drying)

Classes 3: Determination of reaction and oxidoreduction potential (pH, Eh) in liquid and solid samples

Classes 4: Investigation of liquid samples oxygenation (water, wastewater) by Clark electrode method

Classes 5: Determination of salinity in solid and liquid samples.

Classes 6: Estimation of trace amounts of selected heavy metals in environmental samples using FAAS technique.

Classes 7: Spectrophotometry UV/VIS in nitrogen measurements using the Nessler method.

Classes 8-9: Determination of biogenic forms (nitrogen and phosphorus) in liquid samples and extracts using the AA3 autoanalyzer.

Classes 10-11: Estimation of carbon content (organic, inorganic) in solid and liquid samples using TOC-VCSH analyzer.

Classes 12: Investigation of acidity and alkalinity of liquid samples (titration method)

Classes 13-14: Determination of respiration activity as a indicator of biological activity of various samples (gas chromatography)

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture	Exam	Evaluated written exam
W_02	Conventional lecture	Exam	Evaluated written exam
W_03	Conventional lecture Laboratory analysis	Exam Written test	Evaluated written exam/ test
W_04	Laboratory analysis	Observation	Rating card
SKILLS			
U_01	Laboratory classes	Observation / Report	Rating card / Report printout / Report file
U_02	Laboratory classes	Report	Report printout / Report file
U_03	Practical classes	Report	Report printout / Report file
U_04	Laboratory classes	Observation / Report	Rating card / Report printout / Report file
U_05	Laboratory classes	Observation / Report	Rating card / Report printout / Report file
COMPETENCIES			
K_01	Laboratory classes	Observation	Rating card

VI. Grading criteria, weighting factors

Written test to pass the lecture: 100%

Lab classes:

90% grades from written tests

10% reports

Mark	**Evaluation criteria**	
Very good (5)	the student realizes the assumed learning outcomes at a very good level	the student demonstrates knowledge of the education content at the level of 95-100%
overgood (4.5)	the student accomplishes the assumed learning outcomes an over good level	the student demonstrates knowledge of the education content at the level of 85-94 %

Good (4)	the student accomplishes the assumed learning outcomes at a good level	the student demonstrates knowledge of the education content at the level of 75-84%
Quite good (3.5)	the student accomplishes the assumed learning outcomes at a quite good level	the student demonstrates knowledge of the education content at the level of 65-74%
sufficient (3)	the student accomplishes the assumed learning outcomes necessary as prerequisite	the student demonstrates knowledge of the education content at the level of 55-64%
insufficient (2)	the student accomplishes the assumed learning outcomes at an insufficient level	the student demonstrates knowledge of the education content below the level of 55%

VII. **Student workload**

Form of activity	Number of hours
Number of contact hours (with the teacher)	70 (60 + 10 individual consultation)
Number of hours of individual student work	80

VIII. **Literature**

Basic literature
1) Harvey D., Analytical Chemistry 2.0, Electronic Versions, 2009 2) Zhang Ch., Fundamentals of environmental sampling and analysis, Willey, 2007 3) Higson S., Analytical chemistry, Oxford University Press, 2003.
Supplementary literature
1)Price N.C., Dwek R. A., Ratcliffe R. G., Wormald M. R., Principles and problems in physical chemistry for biochemists, Oxford University Press, 2001 2) Scragg A., Environmental biotechnology, Oxford University Press, 2005. 3) Stępniewski W., Stępniewska Z., Bennicelli R.P., Gliński J., Oxygenology in outline, Institute of Agrophysics PAS, Lublin, 2005.