Course name:
Instrumental analysis

ECTS	4.0
Course status	facultative
Course final assessment /evaluation of outcomes	The grade based on Student's work
Prerequisite	Required knowledge of chemistry and biology at high school level.

Main field of study*:*
Agriculture and Horticulture, Biology and Biotechnology (Erasmus+)

Educational profile	General academic
Code of studies and education level	bachelor/engineer (SI) or master of science (SM)
Semester of studies	winter or summer
Language of instruction	English

Course offered by:

Name of faculty offering the course	Faculty of Biotechnology and Horticulture
Name of department offering the course	Department of Plant Biology and Biotechnology
Course coordinator	**dr hab. Sylwester Smoleń, Associate professor**

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands:			
IA_W1	structure and operation of analytical apparatus: AAS, ICP-OES, ICP-MS, HPLC, LC-MS / MS, FIA, discrete analysis, capillary electrophoresis, EPR, GC-MS, N-Kjeldahl and apparatus for measuring photosynthesis activity of plants.	EPB2_W04	R,P
IA_W2	selected application methods analytical apparatus in the analysis of elements and chemical compounds (mineral and organic) in environmental and biological tests as well as anthropogenic origin.	EPB2_W04	R,P
SKILLS – student is able to:			
IA_U1	commissioning and operating at the basic level the following laboratory equipment: AAS, ICP-OES, ICP-MS, HPLC, LC-MS / MS, EPR, GC-MS, discrete analysis, capillary electrophoresis, N-Kjeldahl.	EPB2_U06	R,P
IA_U2	perform calibration curves and determine selected elements and chemical compounds (mineral and organic) in environmental and biological tests as well as anthropogenic origin.	EPB2_U06	R,P
SOCIAL COMPETENCIES – student is ready to:			
IA_K1	taking responsibility for shaping and protecting the natural environment and improving the trophic chain security.	EPB2_K04	R,P
IA_K2	take responsibility for your own safety while working in the laboratory and take responsibility for others as well as entrusted	EPB2_K05	R,P

	analytical equipment.		

Teaching contents

Lectures	0 hours
Topics	n/a
Accomplished learning outcomes	n/a
Means of verification, rules and criteria of assessment	n/a
Classes:	45 hours
Topics	Measurement of nitrate (III), nitrate (V) and ammonium ion in environmental samples by FIA methods and discrete analysis. Measurement of macro-, microelements, heavy metals and trace elements by the AAS, ICP-OES, ICP-MS and nitrogen methods in total using the N-Kjeldahl method. Determination of chlorides and oxalates using a capillary electrophoresis analyzer. Application of HPLC, capillary electrophoresis, and LC-MS detection and UV-VIS absorption spectroscopy for qualitative and quantitative measurements of bioactive substances in plants. Use of an infrared gas analyzer to evaluate photosynthetic parameters. Assessment of the antioxidant potential of plants subjected to environmental stress by the ORAC-fl spectrofluorimetric method. The use of gas chromatography in combination with mass detection (GC-MS) for quantitative and qualitative analysis of the content of fatty acids in plants and / or microbiological cells. Analysis of the anti-radical ability of plant extracts using electron paramagnetic resonance spectrometry.
Accomplished learning outcomes	*IA_W1-W2, IA_K1-K2*
Means of verification, rules and criteria of assessment	Evaluation of the reports of the exercise

References:

Basic	*1. Ruiz-Capillas C., Nollet L.M.L. 2015. Flow Injection Analysis of Food Additives. CRC Press.* *2. Lajunen L. H. J., Perämäk P. 2004. Spectrochemical Analysis by Atomic Absorption and Emission, 2nd Edition Royal Society of Chemistry: Cambridge, UK.* *3. Schmitt-Kopplin, Philippe (ed.) 2008. Capillary Electrophoresis: Methods and Protocols presents a selection of current capillary electrophoresis methods. German Research Center for Environmental Heath. Humana Press.*
Supplementary	*1. M.W. Dong. 2006. Modern HPLC for Practicing Scientists. Wiley.* *2. Timerbaev A.R. 2013. Element speciation analysis using capillary electrophoresis: twenty years of development and applications. Chem. Rev., 113 (1): 778–812.* *3. Prior R., Wu X., Schaich K. (2005) Standardized Methods for the Determination of Antioxidant Capacity and Phenolics in Foods and Dietary Supplements, Agric. Food Chem. 53, 4290−4302.*

Structure of learning outcomes

Area of academic study: R – Agricultural, forestry and veterinary sciences		2.0 ECTS
P – biological sciences		2.0 ECTS
Area of academic study: T – technological sciences		n/a ECTS**

Structure of student activity

Contact hours		49	hrs.	1.9	ECTS**
Including:	lectures		hrs.		
	classes and seminars	45	hrs.		
	consultations	2	hrs.		
	participation in research		hrs.		
	obligatory traineeships		hrs.		
	participation in examination	2	hrs.		
e-learning			hrs.	n/a.	ECTS**
student own work		55	hrs.	2.1	ECTS**

*Areas of academic study in the fields of: H- humanities; S - social studies; P – biological sciences; T – technological sciences; M- medical, sport and health sciences; R – Agricultural, forestry and veterinary sciences; A – the arts

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes