

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	Prof. dr hab. Sylwester Smoleń, 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/MS, HPLC, HPLC+ICP-MS/MS, LC-MS/MS, FIA, discrete analysis, capillary electrophoresis and N-Kjeldahl apparatus.	EPB2_W04	R,P
IA_W2	selected application methods analytical apparatus in the analysis of elements, chemical compounds (mineral and organic eg. sugars, vitamins, speciation forms of elements /iodine and selenium/, alkaloids, bioactive compounds in herbs or pesticides) 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/MS, HPLC, HPLC+ICP-MS/MS, LC-MS/MS, FIA, discrete analysis, capillary electrophoresis and N-Kjeldahl apparatus.	EPB2_U06	R,P
IA_U2	perform calibration curves and determine selected elements and chemical compounds (mineral and organic mineral and organic eg. sugars, vitamins, alkaloids, bioactive compounds in herbs) 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 analytical equipment.	EPB2_K05	R,P

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 and/or discrete analysis methods. Measurement of macro-, microelements by the AAS and/or ICP-OES technique. Measurement of heavy metals and trace elements by ICP-MS/MS mass spectrometer. Measurement of total nitrogen using the N-Kjeldahl method. Determination of vitamin C using a capillary electrophoresis analyser. Determination of chlorides and oxalates using a capillary electrophoresis analyser. Determination of sugars using a capillary electrophoresis analyser. Using HPLC chromatograph in connection with ICP mass spectrometers (HPLC+ ICP-MS/MS) for qualitative and quantitative measurements of speciation forms of iodine and selenium in plant samples. Using HPLC chromatograph in connection with LC-MS/MS mass spectrometers for qualitative and quantitative measurements of water-soluble vitamins (from group B) and/or phenolic and quinoline derivatives in plant and/or biological samples. LC-MS/MS technique for qualitative and quantitative measurements of alkaloids and/or other bioactive compounds in herbs.
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	<ol style="list-style-type: none">1. Ruiz-Capillas C., Nollet L.M.L. 2015. <i>Flow Injection Analysis of Food Additives</i>. CRC Press.2. Lajunen L. H. J., Perämäk P. 2004. <i>Spectrochemical Analysis by Atomic Absorption and Emission</i>, 2nd Edition Royal Society of Chemistry: Cambridge, UK.3. Schmitt-Kopplin, Philippe (ed.) 2008. <i>Capillary Electrophoresis: Methods and Protocols</i> presents a selection of current capillary electrophoresis methods. German Research Center for Environmental Health. Humana Press.
Supplementary	<ol style="list-style-type: none">1. M.W. Dong. 2006. <i>Modern HPLC for Practicing Scientists</i>. Wiley.2. Timerbaev A.R. 2013. <i>Element speciation analysis using capillary electrophoresis: twenty years of development and applications</i>. <i>Chem. Rev.</i>, 113 (1): 778–812.

Structure of learning outcomes

Area of academic study: agriculture and horticulture	2.0 ECTS
Area of academic study: biological sciences	2.0 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. ECTS**
student own work	55	hrs.	2.1 ECTS**

*areas of academic study in the fields of: P – biological sciences; R – agriculture and horticulture

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