STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Analytical and instrumental chemistry		

Field of study	Profile of study (general academic, practical)	Year /Semester
Chemical and Process Engineering	**general academic**	**2/4**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours						No. of credits
Lecture:	**-**	Classes:	**-**	Laboratory: **30**	Project/seminars: **-**	**2**

Status of the course in the study program (Basic, major, other) (university-wide, from another field)

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**2 - 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge:**	The student has ordered knowledge in the field of analytical chemistry and basic knowledge in the field of analytical chemistry obtained as part of the program of classes in analytical and instrumental chemistry.
2	**Skills:**	The student uses basic chemical equipment and laboratory glassware.
3	**Social competencies:**	The student understands the need to learn and improve his/her professional and personal competences.

Assumptions and objectives of the course:
The aim of this course is to familiarize students with the practical use of typical instrumental techniques and analytical methods used in quantitative analysis on the example of determinations selected in the paths: A – Analytical and instrumental chemistry in environmental analysis; B – Analytical and instrumental chemistry in food analysis.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. K_W03 The student distinguishes and is able to assess the possibility of using a given analytical method and / or instrumental technique.
2. K_W07 The graduate knows the principles of operation of control and measurement systems. The graduate understands the principle of operation of the apparatus used in instrumental techniques.

Skills:

1. K_U08 The graduate can plan and conduct simple experiments, interpret their results and draw conclusions. Selects and applies analytical methods and techniques in qualitative and quantitative analysis. Has the ability to perform qualitative and quantitative determinations.
2. K_U05 The graduate has the ability to self-study.
3. K_U12 The graduate applies principles of work in the analytical laboratory.and complies with guidelines concerning health and safety at work.

Social competencies:

1. K_K01 The graduate understands the need to develop and improve his/her professional competencies.
2. K_K03 The graduate is aware of the importance of professional conduct and respect for professional ethics.
3. K_K04 The graduate is aware of the responsibility for his/her own work and the willingness to subordinate teamwork and responsibility for jointly accomplished tasks.

Assessment methods of study outcomes

Verbal and written control of the student's knowledge prior to the commencement of laboratory classes from instrumental analysis. Written reports on the exercises performed.

Course description

The series of laboratory classes includes a series of exercises:

Path A – Analytical and instrumental chemistry in environmental analysis

a. Determination of chemical oxygen demand (COD) by permanganate method
b. Yodometric determination of the active chlorine content in water
c. Determination of oxygen dissolved in water by the Winkler method
d. voltammetric determination of lead
e. Spectrophotometric determination of iron (II) ions in the form of a complex with o-phenanthroline
f. Determination of sodium and potassium in river water
g. Determination of bromides in tap water

Path B - Analytical and instrumental chemistry in food analysis

a. Determination of calcium in drinking water by the manganometrical method
b. Determination of phenol in aromas by bromometric and iodometric methods
c. Determination of acetic acid by the acidimetric potentiometric titration method
d. Spectrophotometric determination of orthophosphates and polyphosphates using the molybdate method with tin (II) chloride as a reducing agent
e. Determination of sodium and potassium in mineral and table water
f. Voltammetric determination of ascorbic acid

Before the series of laboratory classes, students are familiarized with the general principles of health and safety at work in the chemical laboratory, during the classes health and safety instructions regarding a given workplace are given.

Basic bibliography:

1. A. Cygański, Metody spektroskopowe w chemii analitycznej, WNT, Warszawa 1995
2. D.A. Skoog, D.M. West, F.J.Holler, S.R. Crouch, Podstawy chemii analitycznej, T. 1 i 2, PWN, Warszawa 2006
3. A. Cygański, Podstawy metod elektroanalitycznych, WNT, 1999
4. J. Minczewski, Z. Marczenko, Chemia Analityczna. Analiza Instrumentalna, T1, 2, T.3, PWN, Warszawa 1985
5. A. Cygański, Chemiczne metody analizy ilościowej, WNT, Warszawa 2005

Additional bibliography:

1. J. Dojlido, J. Zerbe, Instrumentalne metody badania wody i ścieków, Arkady, Warszawa 1997
2. W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 2002
3. H. Elbanowska, J. Zerbe, J. Siepak, Fizyczno – chemiczne badania wód, Wydawnictwo Naukowe UAM, Poznań 1999

Result of average student's workload

Activity	Time (working hours)
1. consultation for the laboratory	5
2. preparation for the laboratory	10
3. laboratory	30

Student's workload

Source of workload	hours	ECTS
Total workload	45	2
Contact hours	35	0
Practical activities	30	0