A COURSE SYLLABUS – DOCTORAL SCHOOL

REGARDING THE QUALIFICATION CYCLE FROM 2022 TO 2026

GENERAL INFORMATION ABOUT COURSE	
Course title	**Application of chromatography coupled with mass spectrometry in the analysis of biochemical compounds**
Name of the unit running the course	**Doctoral School at the University of Rzeszów**
Type of course *(obligatory, optional)*	optional specialist
Year and semester of studies	I/2
Discipline	biological sciences
Language of Course	english
Name of Course coordinator	Ewa Szpyrka
Name of Course lecturer	Ewa Szpyrka
Prerequisites	Knowledge of biochemistry and analytical techniques

BRIEF DESCRIPTION OF COURSE
(100-200 words)

The aim of the course is to familiarize the doctoral student with the techniques of instrumental analysis - chromatography and mass spectrometry, which are widely used in the analysis of biochemical compounds. The student will gain knowledge about the latest solutions used in these measurement techniques, will gain the ability to operate a gas chromatograph coupled with mass spectrometry, calibrate equipment, analyze and interpret measurement results. In addition, he will gain knowledge and skills in the methods of sample preparation for analysis, methods of their purification and derivatization of analytes. The student will also gain skills in the validation of measurement methods.

COURSE LEARNING OUTCOMES AND METHODS OF EVALUATING LEARNING OUTCOMES

Learning outcome	The description of the learning outcome defined for the course	Relation to the degree programme outcomes (symbol)	Learning Format (Lectures, classes,...)	Method of assessment of learning outcomes (e.g. test, oral exam, written exam, project,...)
Knowledge (no.)	**(Knows and understands)**			
1	- The student knows the division of instrumental analytical methods into particular groups. - Knows the theoretical basis of chromatography and mass spectroscopy, the construction of devices and the principle of their operation. - Knows the methods of sample preparation, purification of extracts and derivatization of analytes. - Knows the operating modes of the apparatus: full scan, selected ion monitoring (SIM) and dynamic multiple reaction monitoring (dMRM). - The student knows the latest achievements and directions of development in the field of these measurement techniques.	P8S_WG1 P8S_WG2 P8S_WG3	lab	Observation during classes, written project

2	The student understands the need for the development of measurement techniques related to the development of civilization.	P8S_WK1	lab	Observation during classes, written project
Skills (no.)	**(Able to)**			
1	- Student is able to prepare samples for analysis, apply appropriate methods of purification of extracts and derivatization of analytes. - The student is able to analyze selected biochemical substances using chromatography coupled with mass spectrometry. - The student correctly interprets the obtained results, validates the research method.	P8S_UW1 P8S_UW2 P8S_UW3	lab	Observation during classes
2	The student is able to use the English terminology in the scope of the discussed measurement techniques.	P8S_UK6	lab	Observation during classes, written project
Social competence (no.)	**(Ready to)**			
1	Recognize the importance of knowledge in the field of instrumental measurement techniques in solving cognitive and practical problems.	P8S_KK3	lab	Observation during classes

LEARNING FORMAT – NUMBER OF HOURS

Semester (no.)	Lectures	Seminars	Lab classes	Internships	others	ECTS
2			15			8

METHODS OF INSTRUCTION

Scientific discussion, work in the laboratory, practical classes.

COURSE CONTENT

Techniques: gas and liquid chromatography and mass spectrometry.
Chromatography coupled with mass spectrometry - the principle of operating the apparatus, preparation of the standard and samples for analysis, method design, calibration of the apparatus, analysis of samples, statistical processing of measurement results, quality assurance.
Methods of preparing samples for analysis, purification of extracts and derivatization of analytes.
Sample analysis in full scan mode, selected ion monitoring (SIM) and dynamic multiple reaction monitoring (dMRM).

COURSE ASSESSMENT CRITERIA

Preparation of a written, review paper on the methods of determination of selected biochemical substances using chromatography coupled with mass spectrometry techniques. Discussion of sample preparation, purification, analysis and determination of validation parameters. Comparison of the discussed methods. The condition for passing the course is the achievement of all assumed learning outcomes. About the evaluation the number of points obtained is decisive: 3.0 - 51-60%; 3.5 - 61-70%; 4.0 - 71-80%; 4.5 - 81-90%; 5.0 - 91-100%.

TOTAL PhD STUDENT WORKLOAD REQUIRED TO ACHIEVE THE INTENDED LEARNING OUTCOMES – NUMBER OF HOURS AND ECTS CREDITS	
Activity	Number of hours
Scheduled course contact hours	15
Other contact hours involving the teacher (consultation hours, examinations)	15
Non-contact hours – student`s own work (preparation for classes or examinations, project, etc.)	170
Total number of hours	200
Total number of ECTS credits	8

INSTRUCTIONAL MATERIALS	
Compulsory literature:	• JM ANDRADE-GARDA, A CARLOSENA-ZUBIETA, MP GÓMEZ-CARRACEDO, MA MAESTRO-SAAVEDRA PROBLEMS OF INSTRUMENTAL ANALYTICAL CHEMISTRY A HANDS-ON GUIDE. WORLD SCIENTIFIC 2017. • DAVID T. HARVEY, ANALYTICAL CHEMISTRY 2.1. DEPAUW UNIVERSITY 2016.
Complementary literature:	Scientific papers

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Date and signature of the Course lecturer

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Approved by the Head of the Department or an authorised person