A COURSE SYLLABUS – DOCTORAL SCHOOL
regarding the qualification cycle from 2022/2023 to 2025/2026
regarding the qualification cycle from 2023/2024 to 2026/2027
regarding the qualification cycle from 2024/2025 to 2027/2028

GENERAL INFORMATION ABOUT COURSE	
Course title	*OPTIONAL SPECIALIZED SUBJECT:* *The importance of biomarkers in medicine.*
Name of the unit running the course	Doctoral School at University of Rzeszów
Type of course *(obligatory, optional)*	compulsory - optional specialist subject
Year and semester of studies	year I, semester II, year II, semester IV, year III, semester VI
Discipline	medical science
Language of Course	English language
Name of Course coordinator	dr hab. n. med. Agnieszka Gala-Błądzińska, prof. UR
Name of Course lecturer	dr hab. n. med. Agnieszka Gala-Błądzińska, prof. UR
Prerequisites	In-depth knowledge of the discipline: medical sciences and related disciplines, possession of a professional medical degree.

BRIEF DESCRIPTION OF COURSE
(100-200 words)

Biomarkers play a key role in the diagnosis, monitoring and prognosis of disease progression.

They are measurable biological indicators, such as proteins, metabolites, or genetic changes, that provide additional information about a patient's health status. Biomarkers can be used in detecting diseases at an early stage, personalizing therapy and evaluating the effectiveness of treatment. Modern medicine uses biomarkers in virtually all fields of medicine. Examples include tumor markers (e.g. PSA in prostate cancer), troponins in the diagnosis of acute coronary syndromes, or neurodegenerative biomarkers in Alzheimer's disease. Developments in technology, such as omics (genomics, proteomics, metabolomics) and so-called artificial intelligence, are making it possible to identify and analyze biomarkers with increasing accuracy, leading to more precise medicine. Despite the enormous potential of biomarkers, their clinical application requires validation and standardization to ensure their effectiveness and safety.

In the future, biomarkers may play a key role in personalized medicine by enabling earlier detection of diseases and tailoring therapies to individual patients.

The goal of the course is to familiarize PhD students with the role of biomarkers in the diagnosis, monitoring and therapy of various diseases. Ph.D. students will gain and consolidate knowledge of biomarker classification, methods for their identification and application in personalized medicine.

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, has knowledge			
P8S_WG/1	He has advanced theoretical knowledge and is familiar with the current scientific achievements, including those of the world of the studied discipline of medical sciences and general issues of related	P8S_WG	Conversatory	Examination/ written work

	disciplines, has knowledge of the significance and place of the chosen scientific discipline in the system of science in confrontation with other disciplines;			
P8S_WG/2	Is versed in the issues of development, latest discoveries and research achievements in the practiced discipline of medical science, including those of global scope;	P8S_WG	Conversatory	Examination/ written work
P8S_WG/3	Knows and defines various types of scientific sources both in Polish and in foreign language within the discipline of medical science and related disciplines;	P8S_WG	Conversatory	Examination/ written work
P8S_WK/1	Knows and understands the impact of the development of technique and technology on the progress of civilization;	P8S_WK	Conversatory	Examination/ written work
Skills (no.)	can			
P8S_UW/1	Based on interdisciplinary knowledge, he is able to identify and solve a research problem, define the purpose of research, formulate a hypothesis and the object of scientific research, develop techniques, methods and research tools, and make conclusions based on the results of scientific research;	P8S_UW	Conversatory	Examination/ written work
P8S_UW/2	Able to use the available scientific literature to diagnose and solve research problems and innovative activities related to the scientific work carried out and also apply the appropriate course of action to create new elements of scientific output;	P8S_UW	Conversatory	Examination/ written work
P8S_UW/3	Is able to use the available interdisciplinary knowledge to analyze and evaluate the results of scientific research, expert works and other publications, forming an opinion, including critical judgments, on this basis;	P8S_UW	Conversatory	Examination/ written work
P8S_UK/6	Is able to carry out research work and professional work based on based on foreign-language literature;	P8S_UK	Conversatory	Examination/ written work
Social competence (no.)	is ready to			

P8S_KK3	With his knowledge, he solves cognitive and practical problems.		P8S_KK	Conversatory	Examination/ written work
Semester (no.)	Lectures	Seminars	Conversatory	Internships	others	ECTS
II, IV, VI	-	-	15 hrs.	-	-	2

METHODS OF INSTRUCTION

- CONVERSATIONS IN THE TRADITIONAL FORM;
- CLASSES WITH MULTIMEDIA PRESENTATION;
- PROJECT;
- DISCUSSION

COURSE CONTENT

Conversatory:
1. Topic: Definition and classification of biomarkers (diagnostic, prognostic, predictive), history, areas of application.
2. Topic: Application of biomarkers in oncology, cardiology, neurology, nephrology and other fields of medicine.
3. Topic: Modern techniques of biomarker analysis (genomics, proteomics, metabolomics), spectrometry.
4. Topic: Challenges of validation and implementation of biomarkers in clinical practice.

COURSE ASSESSMENT CRITERIA

The subject ends with a written exam. The applicable grading scale: 2.0, 3.0, 3.5, 4.0, 4.5, 5.0.

The doctoral student/doctoral candidate prepares a paper on a topic indicated by the teacher on issues related to the subject of the course.

To obtain a passing grade, a conversion factor for the corresponding percentage of points obtained is applied:
- up to 50% - insufficient, (the written work does not meet the criteria)
- 51% - 60% - sufficient, (the written work contains a narrow range of knowledge, supported by basic literature for the subject).
- 61% - 70% - sufficient plus, (the written work contains a range of knowledge, supported by the basic literature for the subject);
- 71% - 80% - good, (written work contains a range of knowledge, supported by primary and secondary literature for the subject);
- 81% - 90% - good plus, (written work contains a comprehensive range of knowledge, supported by primary and secondary literature for the subject);
- 91% - 100% - very good (the written work contains an extensive range of knowledge, supported by literature beyond that obligatory for the subject);

Active attendance in class can raise the grade by half a grade.

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 hrs
Other contact hours involving the teacher (consultation hours, examinations)	1
Non-contact hours – student`s own work (preparation for classes or examinations, project, etc.)	39
Total number of hours	55 hrs.

Total number of ECTS credits	2

INSTRUCTIONAL MATERIALS

Compulsory literature:	Biomerker Research (Springer Nature) Biomarkers in Medicine (Future Medicine Ltd.)
Complementary literature:	Cancer Epidemiology Biomarkers and Prevention (American Association for Cancer research)

*(1 ECTS CREDIT CORRESPONDS TO 25 - 30 HOURS OF THE TOTAL WORKLOAD OF A DOCTORAL STUDENT, NEEDED TO ACHIEVE THE ESTABLISHED EFFECTS).

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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