A COURSE SYLLABUS – DOCTORAL SCHOOL
REGARDING THE QUALIFICATION CYCLE FROM 2024/2025 TO 2027/2028

GENERAL INFORMATION ABOUT COURSE	
Course title	***DOCTORAL DISSERTATION***
Name of the unit running the course	Doctoral School at University of Rzeszów
Type of course *(obligatory, optional)*	obligatory subject
Year and semester of studies	year I -IV, semester: I - VII
Discipline	biotechnology
Language of Course	Polish/English language
Name of Course coordinator	dr hab. Anna Lewińska, prof. UR
Name of Course lecturer	dr hab. Anna Lewińska, prof. UR
Prerequisites	Working knowledge at the academic level in biochemistry, cell biology, molecular biology, materials engineering. Knowledge of English to read scientific texts freely in order to adapt research methods and models for independent work in a biotechnology research laboratory.

BRIEF DESCRIPTION OF COURSE (100-200 words)
The aim of the doctoral laboratory is to prepare the doctoral student by the promoter to conduct research work in the implementation of the doctoral dissertation in the area of medical biotechnology (example research models/techniques: 2D and 3D cell cultures, flow cytometry and imaging, qPCR, western blotting, biochemical and genetic analysis, work with nanomaterials). In particular, practical competencies will be formed as to the design of experimental scientific research, independent performance of scientific experiments, processing of obtained research results (graphical and statistical processing with the use of adequate computer programs), writing scientific articles and a doctoral dissertation, which will be associated with the acquisition of the ability to critically evaluate the results of one's own research against the background of available professional literature (in-depth analysis of English-language scientific articles of international scope).

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_WG1	Professional literature on the theoretical basis of the dissertation issues, as well as current experimental data in the field of biotechnology in the broadest sense, especially therapy-induced senescence, the application of senolytics and nanomaterials in senotherapy.	**P8S_WG**	laboratory	report
P8S_WG2	Directions of development of biotechnology research based on analysis of the latest discoveries in world biomedicine.	**P8S_WG**	laboratory	report

P8S_WG3	Conceptual grid of biotechnology and broadly defined biomedicine in both Polish and English.	P8S_WG	laboratory	report
P8S_WG4	Modern biotechnology research methodology (methods/ models/research tools) to assist in the design and execution of research experiments in the field of biomedicine in the broadest sense, especially medical biotechnology.	P8S_WG	laboratory	report
Skills (no.)	can			
P8S_UW1	He is able to diagnose research problems, formulate research hypotheses and define the objectives of biotechnology research with a with a proposal of methodology to answer the posed research questions in the field of biomedicine, and is able to accurately draw conclusions on the basis of experimental research.	P8S_UW	laboratory	report
P8S_UW2	He is able to review the literature to propose solutions to specific research problems in the field of modern biotechnology based on modern research techniques.	P8S_UW	laboratory	report
P8S_UW3	Apply the acquired theoretical knowledge in order to interpret experimental data with a with their critical evaluation.	P8S_UW	laboratory	report
Social competence (no.)	is ready to			
P8S_KK1	Critically evaluate one's own scientific achievements against the background of the achievements of world biotechnology, with particular emphasis on the analysis of the contribution of one's own research in the development of medical biotechnology.	P8S_KK	laboratory	report

LEARNING FORMAT – NUMBER OF HOURS

Semester (no.)	Lectures	Seminars	Lab classes	Internships	others	ECTS
I - VIII	-	-	8 x 30 hrs. – 240 hrs.	-	-	24

METHODS OF INSTRUCTION

- conversations in the traditional form;
- discussion;

- performing experiments and experiments;
- conducting research

COURSE CONTENT

labs :

semester I
Topic: Introduction to the principles of work in a biotechnology laboratory (occupational safety and health, good laboratory practice), including the principles of sterile work (in vitro cell culture), working with proteins and nucleic acids, working with the use of advanced technological research equipment, such as flow cytometry or imaging cytometry
Topic: development of an overall research plan relevant to the realization of the dissertation on the basis of previously formulated research hypotheses and research objectives (general objectives and specific)
Topic: Selection of models, techniques and research tools and their implementation for successful execution of the developed general research plan in the execution of the dissertation

semester II
Topic: Conducting scientific experiments in the implementation of the dissertation (development of *in vitro* cellular aging models - chemotherapy-induced senescence
in skin cancer cells)
Subject: Conducting scientific experiments in the implementation of the doctoral dissertation (selection of surface markers of old cancer cells (skin cancer), chemotherapy-induced senescence - part 1)
Subject: Conducting scientific experiments in the framework of the implementation of the doctoral dissertation (selection of surface markers of senescent cancer cells (skin cancers), senescence induced by chemotherapy - part 2)

semester III
Topic : Conducting scientific experiments as part of the dissertation (determining the senolytic effect of newly synthesized quercetin derivatives against senescent skin cancer cells - part 1)
Subject: Conducting scientific experiments as part of the dissertation (determining the senolytic effect of newly synthesized quercetin derivatives against senescent skin cancer cells - part 2)
Subject: Conducting scientific experiments as part of the dissertation (determining the senolytic effect of newly synthesized quercetin derivatives against senescent skin cancer cells - part 3)

semester IV
Topic: Data analysis and interpretation - part 1
Topic: Conducting scientific experiments as part of the dissertation (studying the biological effects of a multifunctional nanoplatform consisting of antibodies targeting old skin cancer cells and senolytic drugs, including the mechanisms of action - part 1)
Subject: Conducting scientific experiments as part of the completion of the dissertation (studying the biological effects of a multifunctional nanoplatform consisting of antibodies targeting senescent skin cancer cells and senolytic drugs, along with providing the mechanisms of action - part 2)

semester V
Topic: Conducting scientific experiments as part of the dissertation (validation of obtained results on a 3D model - part 1)
Topic: Data analysis and interpretation - part 2
Topic: Conducting scientific experiments in the implementation of the dissertation (validation of the obtained results on the 3D model - part 2)

semester VI
Topic: Data analysis and interpretation - part 3
Subject: Preparation of manuscripts of scientific articles on the basis of received experimental results - part 1
Subject: Preparation of manuscripts of scientific articles on the basis of obtained experimental results - part 2

semester VII
Topic: Preparing manuscripts of scientific articles on the basis of received experimental results - part 3
Topic: Preparing a doctoral dissertation - part 1
Topic: Preparing a doctoral dissertation - part 2
semester VIII
Topic: Preparation of the doctoral dissertation-part 3
Topic: Preparation of the dissertation- part 4
Topic: Preparing the doctoral dissertation-part 5

COURSE ASSESSMENT CRITERIA

The evaluation is based on the systematic and ongoing work of the doctoral student in each semester and academic year in terms of: implementation of research, expansion of knowledge, study of literature, involvement and progress in the preparation of the dissertation. As part of the credit, the doctoral student will also be evaluated on the basis of written work, discussion and activity in class. Possible semester grades are: 2.0, 3.0, 3.5, 4.0, 4.5, 5.0.

To obtain a passing grade, a conversion factor is applied for the corresponding percentage of points obtained:

- up to 50% - insufficient, (the doctoral student does not make progress in scientific research, does not expand his knowledge, does not study the readings, does not participate in substantive discussion, does not fulfill his scientific duties);
- 51% - 60% - sufficient, (the doctoral student makes negligible progress in scientific research, expands knowledge, studies primary literature, the discussion held is limited to a narrow range of substantive knowledge, fulfills basic scientific duties);
- 61% - 70% - sufficient plus, (the doctoral student makes progress in scientific research, expands knowledge, studies basic literature, substantively participates in the discussion , discharges scientific duties);
- 71% - 80% - good, (doctoral student makes significant progress in scientific research, expands knowledge, studies primary and secondary literature, substantively participates in discussion, fulfills all scientific duties);
- 81% - 90% - good plus, (the doctoral student makes significant progress in scientific research, systematically expands knowledge, studies basic and complementary literature, substantively participates in discussion, fulfills all scientific duties);
- 91% - 100% - very good (the doctoral student makes significant progress in scientific research, systematically expands knowledge, studies basic, complementary and beyond the obligatory literature, substantively participates in discussion, fulfills all scientific duties).

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	**8 x 30 hrs - 240 hrs.**
Other contact hours involving the teacher (consultation hours, examinations)	10
Non-contact hours – student`s own work (preparation for classes or examinations, project, etc.)	470
Total number of hours	720
Total number of ECTS credits*	**24**

INSTRUCTIONAL MATERIALS

Compulsory literature:	**PUBMED BIOMEDICAL JOURNAL DATABASE (HTTPS://PUBMED.NCBI.NLM.NIH.GOV/)**

Complementary literature:	PubMed biomedical journal database (https://pubmed.ncbi.nlm.nih.gov/)

*(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