A COURSE SYLLABUS – DOCTORAL SCHOOL

REGARDING THE QUALIFICATION CYCLE FROM 2022 TO 2026

GENERAL INFORMATION ABOUT COURSE	
Course title	**Doctoral Seminar**
Name of the unit running the course	Doctoral School at the University of Rzeszów
Type of course *(obligatory, optional)*	obligatory
Year and semester of studies	1st , 2nd, 3rd, 4th, semesters, Ist and IInd year
Discipline	Physical sciences, medical sciences
Language of Course	Polish/English
Name of Course coordinator	Dr hab. n. med. David Aebisher, Prof UR
Name of Course lecturer	Dr hab. n. med. David Aebisher, Prof UR
Prerequisites	Physics, physical chemistry at master level

BRIEF DESCRIPTION OF COURSE
(100-200 words)

An important problem in the fight against cancer is the development of a mechanism that enables selective and effective destruction of cancer cells with no impact on the functioning of healthy tissues. PDT is a procedure that allows the induction of photocytotoxic reactions resulting from the activation of the previously administered photosensitizer directly in the area of pathological changes. The photosensitizer is one of the most important factors that is responsible for the successful conduct of light therapy. The selection of the photosensitizer results in the effectiveness of the photodynamic therapy process. The photosensitizer should have the following characteristics: be a pure commercially available chemical substance, have low toxicity in the dark, but strong photocytotoxicity, have good selectivity towards cancer cells, react in the wavelength range - 600-800 nm, which allows deeper penetration of light, it should be quickly cleared from the body and can be administered in many ways: directly on the skin, orally, intravenously or inhaled.
The aim of the course is to investigate the photo-physical properties of the photosensitizer Indocyanine green in the efficiency of singlet oxygen generation in the process of reactions occurring in photodynamic therapy
in order to obtain a response to increase the efficiency of generating singlet oxygen $^1O_2$. Within the scope of this project, the measurement of oxygen consumption during the photodynamic process will be measured using a laser technique using FluoTime. As a result, the amount of singlet oxygen and other small amounts of free radicals in aqueous solutions, tumor cells and brain tumor tissue will be determined.

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)**			
K1	World achievements and theoretical foundations of issues (also in a foreign language) related to chemical processes occurring during photodynamic therapy	P8S_WG1 P8S_WG3	Classes	project
K2	Directions of the latest research in the field of medicine related to photodynamic therapy	P8S_WG2	Classes	project
Skills (no.)	**(Able to)**			
S1	Use the knowledge of physics, chemistry, and medicine to	P8S_UW1	Classes	project

	describe the phenomena and design research methods for photodynamic therapy			
S2	Use the research literature in the field of her research, make a critical assessment of it, and make her own contribution as a result of the conducted research	P8S_UW2 P8S_UW3	Classes	project
S3	Use English at the B2 level to the extent that allows one to use the scientific achievements of other researchers as well as to start discussions with them	P8S_UK6	Classes	project
Social competence (no.)	**(Ready to)**			
SC1	Critical evaluation of scientific achievements in the discipline of medical sciences in the area of their research	P8S_KK1	Classes	project
SC2	Recognition of knowledge as a decisive criterion in solving the encountered research problems	P8S_KK3	Classes	project

LEARNING FORMAT – NUMBER OF HOURS

Semester (no.)	Lectures	Seminars	Lab classes	Internships	others	ECTS
1st , 2nd, 3rd,4th		30				4

METHODS OF INSTRUCTION

Seminar , presentation, discussion

COURSE CONTENT

Year I: 2022/2023, semester I and II
1. Research methodology in the physical sciences with medical applications
2. Review of the literature and determination of the current state of knowledge in the field of photodynamic therapy
3. Spectroscopic methods in physical research with medical applications
4. Physical and chemical basis of fluorescence and phosphorescence
5. Preparation of an article presenting the obtained results

Year II: 2023/2024, semester III and IV
1. Quantum efficiency of fluorescence and phosphorescencemin in physical sciences with medical applications
2. Analysis of the singlet oxygen generation model in photodynamic therapy
3. Properties of indocyanine green photosensitizer
4. Preparation of articles presenting research results

COURSE ASSESSMENT CRITERIA

The pass mark is an active participation in the seminar consisting in asking questions and conducting a substantive discussion on the presentation of the research results presented during the seminar

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	30h
Other contact hours involving the teacher (consultation hours, examinations)	15h
Non-contact hours – student`s own work (preparation for classes or examinations, project, etc.)	60h
Total number of hours	105h
Total number of ECTS credits	4

INSTRUCTIONAL MATERIALS	
Compulsory literature:	1) Lasers and Current Optical Techniques in Biology, Ed. G. Palumbo and R. Pratesi RSC, Cambridge (2004), pp. 658, ISBN 0-85404-321-7 2) Singlet Oxygen: Applications in Biosciences and Nanosciences, Ed. S. Nonell, C. Flors RSC, Cambridge (2016), pp.798, ISBN 978-1-78262-696-1 3) J. Lakowicz, Principles of Fluorescence Spectroscopy, Springer 2010 4) P. Kapusta, M. Wahl, R. Erdmann, Advanced Photon Counting, Springer 2015
Complementary literature:	1) Photodynamic Therapy, Ed. T. Patrice, RSC, Cambridge (2003), pp. 384, ISBN 0-85404-306-3 2) Prebiotic Photochemistry: From Urey–Miller-like Experiments to Recent Findings, Ed. Franz Saija, Giuseppe Cassone, RSC, Cambridge (2021), pp.308, ISBN 978-1-83916-177-3