A COURSE SYLLABUS – DOCTORAL SCHOOL

REGARDING THE QUALIFICATION CYCLE 2025/2026 TO 2028/2029

GENERAL INFORMATION ABOUT COURSE	
Course title	**RESEARCH METHODOLOGY**
Name of the unit running the course	Rzeszów University Doctoral School
Type of course *(obligatory, optional)*	obligatory
Year and semester of studies	Year I, Semesters I-II
Discipline	**Technical Information Technology and Telecommunications**
Language of Course	Polish language
Name of Course coordinator	**Dr Barbara Pękala, Professor at the University of Rzeszów**
Name of Course instructor	**Dr Barbara Pękala, Professor at the University of Rzeszów**
Prerequisites	Knowledge, skills, and social competences related to research methodology, achieved at level 7 of the Polish Qualifications Framework in the discipline of Technical Information Technology and Telecommunications.

BRIEF DESCRIPTION OF COURSE
(100-200 words)

The aim of the "Research Methodology" course is to familiarize doctoral students with the principles of planning, conducting, and presenting research in the discipline of technical computer science and telecommunications. During the course, doctoral students will learn the basic stages of the research process, including identifying a research problem, formulating scientific hypotheses, selecting research methods and tools, and analyzing and interpreting research results.
An important element of the course is also to familiarize doctoral students with methods of data analysis, designing computational experiments, modeling information systems, and using artificial intelligence tools in scientific research. Particular attention will be paid to methods of modeling data uncertainty, including fuzzy set theory and approximate inference systems used in data analysis and decision support.

The course develops competencies in critical analysis of scientific literature, preparing scientific publications, and presenting research results in national and international settings.

COURSE LEARNING OUTCOMES AND METHODS OF EVALUATING LEARNING OUTCOMES

Learning outcome	The description of the learning outcome defined for the course	Reference to learning outcomes for qualifications at Level 8 of the Polish Qualification Framework (PRK) (symbol)	Learning Format (Lectures, classes,...)	Method of assessment of learning outcomes (e.g. test, oral exam, written exam, project,...)
Knowledge: (no.)	***knows and understands***			
P8S_WG3	Knows, understands, and applies specialized terminology used in the national and international scientific and professional communities in the scientific discipline of technical information technology and	**P8S_WG**	seminar	project, discussion

	telecommunications, in which the research is planned.			
P8S_WG4	Possesses extensive knowledge of applied scientific research methodology in the discipline of technical information technology and telecommunications, utilizing interdisciplinary research tools and techniques to obtain the most reliable and objective research results.	**P8S_WG**	seminar	written assignments, project
P8S_WK3	Possesses extensive knowledge of the transferability of research findings to the economic and social spheres.	**P8S_WK**	seminar	written assignments, project
Skills: (no.)	***is able to***			
P8S_UW1	The student can utilize interdisciplinary knowledge to identify and practically solve research problems by defining the research goal, subject, and hypothesis, developing innovative research methods, techniques, and tools, and drawing conclusions based on research results.	**P8S_UW**	seminar	project, discussion
P8S_UK1	Actively participate in the national and international scientific and professional communities, sharing the results of their research work.	**P8S_UK**	seminar	written assignments, project
P8S_UO1	Through active participation in the national and international research community, the student participates in individual and team research projects, playing various roles.	**P8S_UO**	seminar	written assignments, project
Social competence: (no.)	***is ready to***			
P8S_KR1	Strengthening and developing the ethos of research/creative communities, including conducting scientific/artistic activities independently, taking into account the principles of intellectual property protection and public ownership of research results.	**P8S_KR**	seminar	project, discussion

LEARNING FORMAT – NUMBER OF HOURS

Semester (no.)	Lectures	Seminars	Lab classes	Placements	other	ECTS
I	-	-	-	-	**30**	**3**
II	-	-	-	-	**30**	**3**
total:	-	-	-	-	**60**	**6**

METHODS OF INSTRUCTION

- traditional seminar;
- seminar with multimedia presentation;
- project;
- discussion.

COURSE CONTENT

Semester I

• Fundamentals of scientific research methodology in technical computer science and telecommunications.
• Formulating a research problem, scientific hypotheses, and research objectives.
• Methods of data acquisition and analysis in computer science research.
• Designing computational experiments and computer simulations.
• Modeling information systems and analyzing research results.
• Fundamentals of data uncertainty modeling – introduction to fuzzy set theory.

Semester II

• Artificial intelligence methods in scientific research.
• Approximate inference systems and their application in data analysis.
• Methods of analyzing large data sets (Big Data) in computer science research.
• Critical analysis of scientific literature and preparation of scientific articles.
• Principles of publishing research results in scientific journals and at conferences.
• Transfer of research results to the economy and commercialization of scientific research results.

COURSE ASSESSMENT CRITERIA

The course is taught in semesters I to II. After semester I, the course concludes with a credit grade of ZO1, and after semester II, the course concludes with an E2 exam. The course is conducted in direct contact between the doctoral candidate and their supervisor or assistant supervisor.

The condition for passing the course after semester I is submitting a report on the project's completion. The condition for passing the course exam after semester II is obtaining at least 51% of the points on the written paper.

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

- up to 50% - unsatisfactory (the doctoral student makes no progress in their research, does not expand their knowledge, does not study the required reading, does not participate in substantive discussions, and does not fulfill their research obligations);

- 51% - 60% - satisfactory (the doctoral student makes little progress in their research, expands their knowledge, studies primary literature, the discussion is limited to a narrow scope of substantive knowledge, and fulfills their basic research obligations);

- 61% - 70% - satisfactory plus (the doctoral student makes progress in their research, expands their knowledge, studies primary literature, participates substantively in discussions, and fulfills their research obligations);

- 71% - 80% - good (the doctoral student makes significant progress in their research, expands their knowledge, studies primary and secondary literature, participates substantively in discussions, and fulfills all their research obligations);

- 81% - 90% - good plus (the doctoral student makes significant progress in their research, systematically expands their knowledge, studies primary and secondary literature, participates substantively in discussions, and fulfills all their research obligations);

- 91% - 100% - very good (the doctoral student makes significant progress in their research, systematically expands their knowledge, studies primary, secondary, and non-relevant literature, participates substantively in discussions, and fulfills all their research obligations);

TOTAL DOCTORAL STUDENT WORKLOAD REQUIRED TO ACHIEVE THE EXPECTED LEARNING OUTCOMES – NUMBER OF HOURS AND ECTS CREDITS

Activity	Number of hours
Scheduled course contact hours	**2 x 30 = 60 hrs.**
Other contact hours involving the instructor (duty hours, examinations)	**4**
Non-contact hours – student`s own work (preparation for classes or examinations, project, etc.)	**116 hrs.**
Total number of hours	**180**
Total number of ECTS credits	**6**

INSTRUCTIONAL MATERIALS

Compulsory literature:	1. Creswell J., **Research Design: Qualitative, Quantitative, and Mixed Methods Approaches**, 2018, SAGE Publications. 2. Russell S., Norvig P., **Artificial Intelligence: A Modern Approach**, 2021, Pearson. 3. Ross T., **Fuzzy Logic with Engineering Applications**, 2016, Wiley. 4. Kaur J., Khehra B., **Applications of Fuzzy Logic in Medical and Engineering Systems**, 2022, Springer.
Complementary literature:	1. Goodfellow I., Bengio Y., Courville A., **Deep Learning**, 2016, MIT Press. 2. Klir G., Yuan B., **Fuzzy Sets and Fuzzy Logic: Theory and Applications**, 1995, Prentice Hall. 3. Pedrycz W., Gomide F., **An Introduction to Fuzzy Sets: Analysis and Design**, 2007, MIT Press.

*(1 ECTS POINT CORRESPONDS TO 25–30 HOURS OF TOTAL WORK BY THE DOCTORAL STUDENT REQUIRED TO ACHIEVE THE INTENDED RESULTS)

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Date and signature of the Course instructor

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Approved by the Head of the Department or an authorised person