DESCRIPTION OF THE COURSE OF STUDY

Course code		
Name of the course in	Polish	**Mechanika kwantowa**
	English	**Quantum Mechanics**

1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

1.1. Field of study	physics
1.2. Mode of study	Full-time
1.3. Level of study	3rd degree
1.4. Profile of study	General academic
1.5. Person/s preparing the course description	Prof. dr hab. Francesco Giacosa
1.6. Contact	**fgiacosa@ujk.edu.pl**

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	English
2.2. Prerequisites	algebra, mathematical analysis, basic physics, basics quantum mechanics, electrodynamics

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		Lecture
3.2. Place of classes		Courses in the UJK teaching rooms of the Faculty of Exact and Natural Science
3.3. Form of assessment		Oral and written exam
3.4. Teaching methods		Lectures, problem solving (numerical and analytical)
3.5. Bibliography	**Required reading**	1. J. J. Sakurai, Modern Quantum Mechanics 2. R. MacKenzie , Path integral methods and applications, quantph/ 0004090
	Further reading	Quantum field theory in a nutshell, A. Zee, first chapter.

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives (including form of classes)
Knowledge (lectures and laboratories) C1. Description of the most important features and formalism of modern quantum mechanics. **Abilities (laboratories and project)** C2. Understanding the mathematical tools related to advanced quantum mechanics (focused on path integrals). C3. Developing skills to solve exercises.

4.2. Detailed syllabus (including form of classes)

Lectures:
1. Recall of the fundaments of QM: Schroedinger equation and its properties.
2. Recall of the fundaments of QM: Heisenberg formalism and its properties.
3. Path integral in QM; formal derivation.
4. Examples of path integrals: free case, two-slit experiment.
5. Link of path integral to Quantum Field Theory.
6. Link of path integral to thermodynamics.
7. Perturbation theory and asymptotic series.
8. Recall of electrodynamics and the Aharonov-Bohm effect.
9. Spin: operators, commutations properties.
10. Composition of spins.

4.3. Education outcomes in the discipline

Code	A student, who passed the course	Relation to learning outcomes
	within the scope of **KNOWLEDGE:**	
W01	has extended knowledge of the latest scientific achievements, including theoretical foundations, general issues and selected specific issues appropriate to the scientific discipline covering scientific issues that are the subject of the doctoral dissertation	P8U_W P8S_WG
	within the scope of **ABILITIES:**	
U01	is able to define the purpose and subject of research, formulate research hypotheses in the field of discipline covering scientific issues that are the subject of a doctoral dissertation	P8U_U P8S_UW
	within the scope of **SOCIAL COMPETENCE:**	
K01	can justify considerable knowledge in solving cognitive and practical problems	P8U_U P8S_KK

4.4. Methods of assessment of the intended learning outcomes

Teaching outcomes (code)	Method of assessment (+/-)																				
	Oral answer			Project			Self-study			Group work			Exam								
	Form of classes			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*		
	L	C	P	L	C	P	L	C	P	L	C	P	L	C	P	L	C	P	L	C	P
W01													X								
U01													X								
K01													X								

4.5. Criteria of assessment of the intended learning outcomes

Form of classes	Grade	Criterion of assessment
lecture (L)	3	at least 50% and not more than 60% of the total number of available points
	3,5	more than 60% and not more than 70% of the total number of available points
	4	more than 70% and not more than 80% of the total number of available points
	4,5	more than 80% and not more than 90% of the total number of available points
	5	more than 90% of the total number of available points
classes (C)	3	at least 50% and not more than 60% of the total number of available points
	3,5	more than 60% and not more than 70% of the total number of available points
	4	more than 70% and not more than 80% of the total number of available points
	4,5	more than 80% and not more than 90% of the total number of available points
	5	more than 90% of the total number of available points
project (P)	3	at least 50% and not more than 60% of the total number of available points
	3,5	more than 60% and not more than 70% of the total number of available points
	4	more than 70% and not more than 80% of the total number of available points
	4,5	more than 80% and not more than 90% of the total number of available points
	5	more than 90% of the total number of available points

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	Student's workload	
	Full-time studies	Extramural studies
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	***30***	
Participation in lectures	30	
Participation in laboratories/project		
Preparation for the exam		
Others		
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	*30*	
Preparation for the lecture	15	
Preparation for the laboratories		
Preparation for the exam	15	
Gathering materials for the project		
Preparation of multimedia presentation		
Others*		
TOTAL NUMBER OF HOURS	**60**	
ECTS credits for the course of study	**3**	

Accepted for execution *(date and signatures of the teachers running the course in the given academic year)*

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