

Subject card

Subject name and code	Introduction to Quantum Mechanics, PG_00205751						
Field of study	Quantum Information Technology						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
Education level	Master's studies	Subject group			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			English		
Semester of study	1	ECTS credits			7.0		
Learning profile	academic	Assessment form			exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Mazurek				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	60.0	0.0	0.0	0.0	90
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	90		0.0		85.0	175
Subject objectives	The aim of this course is to provide the student with the motivation behind postulates and tools of Quantum Mechanics, starting with two level photonic systems: polarization of a monochromatic electromagnetic wave and Malus law. Rigorous mathematical constructions are provided in the accompanying course Mathematical Methods of Quantum Information.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[QITL3_W01] knows and understands in depth selected facts, objects, and phenomena, as well as the methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of quantum information technologies.						
	[QITL3_U02] is able to use their knowledge of quantum information technologies – formulate and solve complex and unusual problems and perform tasks innovatively in unpredictable conditions by appropriately selecting sources and information derived from them, evaluating, critically analyzing, synthesizing, creatively interpreting, and presenting this information.						

Subject contents	<p>* Inconsistencies in Classical Physics: Blackbody Radiation. Quantum Theory of Light and Plancks distribution, Photoelectric Effect, Compton Effect.</p> <p>* Wave Nature of Matter : De Broglie Hypothesis. Wave-Particle Duality. Probability. Wave Amplitude and Wave Functions. Heisenbergs Uncertainty Principle. Single slit diffraction and the double slit experiment. MachZehnder interferometer.</p> <p>* Basic Postulates and Formalism: Energy and Momentum Operators. Schrödinger Wave Equation. Properties and Interpretation of Wave Function and Probabilities. Linearity, Superposition and Collapse of wave functions. Eigenvalues, Eigenfunctions and Expectation Values.</p> <p>* Applications of Schrodinger Equation: One dimensional box, Harmonic Oscillator, and Hydrogen Atom.</p> <p>* Scattering Problems: Probability current and continuity equation. Tunnelling through Finite Potential Step, Attractive and Repulsive potential barriers.</p> <p>* Approximation methods for stationary states: Time independent perturbation theory and its applications in atomic physics. Space quantization of angular momentum, Zeeman Effects and Spin angular momentum. Larmors precession.</p> <p>* Diracs matrix Notation. Second quantization of harmonic oscillator. Ladder operators and their algebra.</p> <p>* Quantum Entanglement and Bell Inequality. PPT criterion for entangled states and negativity.</p>											
Prerequisites and co-requisites	None.											
Assessment methods and criteria	<table border="1" data-bbox="448 1050 1487 1155"> <thead> <tr> <th data-bbox="448 1050 794 1084">Subject passing criteria</th> <th data-bbox="794 1050 1141 1084">Passing threshold</th> <th data-bbox="1141 1050 1487 1084">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1084 794 1117">lecture part: exam</td> <td data-bbox="794 1084 1141 1117">51.0%</td> <td data-bbox="1141 1084 1487 1117">50.0%</td> </tr> <tr> <td data-bbox="448 1117 794 1155">tutorial part: test</td> <td data-bbox="794 1117 1141 1155">51.0%</td> <td data-bbox="1141 1117 1487 1155">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	lecture part: exam	51.0%	50.0%	tutorial part: test	51.0%	50.0%
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Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<p>Principles of Quantum Mechanics, Ramamurti Shankar</p> <p>Quantum Computation and Quantum Information, Michael Nielsen, Isaac Chuang</p> <p>None.</p>										
Example issues/ example questions/ tasks being completed												
Work placement	Not applicable											

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