II (B) OPIS POSZCZEGÓLNYCH PRZEDMIOTÓW		
II B 1.	**Nazwa przedmiotu** *(course title)*	**Selected Topics in Quantum Physics**
II B 2.	**Kod przedmiotu** *(course code)*	
II B 3.	**Typ przedmiotu** *(type of course)*	Obligatory *(compulsory/obligatory*)
II B 4.	**Poziom przedmiotu** *(level of course)*	Advanced
II B 5.	**Rok studiów, semestr** *(year of study, semester/trimester)*	1st year, 1st semester of the graduate level
II B 6.	**Liczba punktów** *(number of credits)*	5
II B 7.	**Metody nauczania** *(teaching methods)*	15 weeks, including: ✓ Lectures – 2 h/week ✓ Exercises – 2 h/week
II B 8.	**Język wykładowy** *(language of course)*	English
II B 9.	**Imię i nazwisko wykładowcy** *(name of lecturer)*	Prof. Dr. Karol Kołodziej, Prof. Dr. Jacek Syska
II B 10.	**Wymagania wstępne** *(prerequisites)*	Quantum mechanics
II B 11.	**Cele przedmiotu** (wskazane jest określenie celów jako efektów kształcenia i kompetencji) *(objectives of the course, preferably expressed in terms of learning outcomes and competences)*	Completion of this course should enable the student to comprehend the advanced topics in quantum physics listed below and perform calculations on his/her own while doing research on related subjects.
II B 12.	**Treści merytoryczne przedmiotu** *(course contents)*	Dirac equation: relativistic covariance of the Dirac equation, solutions for a free particle and antiparticle in the momentum space, projection operators onto states of definite energy and spin; helicity basis; Dirac algebra, covariant bilinear forms; Dirac equation for an electron in an external electromagnetic field, gauge invariance; discrete transformations: parity, charge conjugation, time reflection; Foldy-Wauthuysen transformation; relativistic approach to the hydrogen atom, classification of energy levels. The method of second quantization for bosons and fermions. Scattering theory: Moller operators i and the scattering operator S, Lippmann-Schwinger equations, Feynman propagators, differential cross sections, optical theorem, partial wave expansion and a phase shift, discussion of the unitarity and analyticity properties of the S matrix; electron scattering off the static electric charge distribution, elastic and deep inelastic electron scattering off protons, form factors.
II B 13.	**Metody oceny** *(assessment methods)*	Active participation in exercises, oral examination
II B 14.	**Spis zalecanych lektur** (*recommended reading*)	Basic reading: J. D. Bjorken, S.D. Drell, „Relativistic quantum theory”, McGraw-Hill, Inc. C. Itzykson, J.-B. Zuber, ”Quantum Field Theory”, McGraw-Hill,

		Inc. A. Bohm, „Quantum Mechanics, Foundations and Applications”, Springer-Verlag Supplementary reading: J. R. Taylor, "Scattering Theory", John Wiley & Sons, Inc. M. D. Scadron, "Advanced Quantum Theory", second ed.: Springer-Verlag, 1991. L. I. Schiff, "Quantum mechanics", McGraw-Hill, Inc.