Module	***Relativistic Quantum Electrodynamics***
Code	76017
Instruction language	English
ECTS credits	6
Credit hours	5
Duration	1 semester
Cycle	irregular
Coordinator	Dean of Physics studies
Lecturer	Prof. Wolfgang Schleich
Allocation to study programmes	Physics M.Sc., elective module, 1st or 2nd semester Wirtschaftsphysik M.Sc., elective module, 1st – 3rd semester
Formal prerequisites	
Recommended prerequisites	Quantum Mechanics course Classical Electrodynamics course
Learning objectives	Students who successfully passed this module • know the relativistic formulation of quantum mechanics • know the formalism of second quantization and can perform elementary calculations for electron/positron and photon fields • know how the coupling between electron and photon fields is established • understand the theoretical perturbative approach for the electron-photon interaction using Feynman graphs • are able to reproduce simple Feynman diagrams • are familiar with the conventions and the mathematical methods relevant for this research area (operator algebra, Fourier integrals, covariant formulation, tensors)
Syllabus	• Relativistic quantum mechanics (Dirac equation) • Second quantization • Electron-Photon interaction through the principle of minimal coupling • Feynman rules and calculation of simple Feynman diagrams • Techniques and problems of Feynman graphs, renormalization
Literature	• C. Cohen-Tannoudji, B. Diu und F. Laloë: Quantum Mechanics, Vol. I and II (Wiley, New York, 1977) • L.D. Landau und E.M. Lifshitz: Quantum Mechanics (Pergamon Press, New York, 1958) • J.I. Sakurai: Advanced Quantum Mechanics (Addison-Wesley, Redwood, 1987) • C. Itzykson und J.B. Zuber: Quantum Field Theory (McGraw-Hill, New York, 1966) • F. Mandl und G. Shaw: Quantum Field Theory (Wiley, New York, 1984)
Teaching and learning methods	Lecture (3 hours per week) Exercise (2 hours per week)
Workload	45 hours lecture (attendance time) 30 hours exercise (attendance time) 105 hours self-study and exam preparation

	Total: 180 hours
Assessment	Written or oral examination. Form and scope of the examination is determined and notified by the lecturer at the beginning of the course.
Examination	16017 Relativistic Quantum Electrodynamics 16517 Relativistic Quantum Electrodynamics (Precourse)
Grading procedure	The module grade is the examination grade.
Basis for	Research in the field of quantum physics