Course Title :	**Quantum Field Theory**
Number of hours/semester :	60 h, 1st Semester
Number of ECTS :	6
Lecture outline, contents :	Plan of the lectures: 1. Preliminary course on Group Theory (Notions of Lie Groups and Lie Algebras, SU(2) and SO(3), Lorentz and Poincaré groups, representations) 2. Classical field theory : Lagrangian formalism, variational principle, Euler-Lagrange equations 3. Relativistic fields : free real scalar field, Klein-Gordon equation, Noether theorem ; Complex scalar field and U(1) invariance. 4. Quantization of the free scalar field. 5. Free Dirac field : Spinors, Dirac equation. 6. Quantization of the free Dirac field. 7. U(1) gauge-invariance ; Maxwell field. 8. Scalar field coupled to a source : Klein-Gordon propagator 9. Interactions : Asymptotic states, scattering amplitudes, S-matrix , reduction formulae, correlation functions. 10. Perturbation expansion ; Feynman diagrams in scalar field theory. 11. Quantum Electrodynamics : Fermion and Photon propagators, Feynman diagrams, calculation of tree level processes. 12. Spontaneous symmetry breaking : Goldstone and Higgs in abelian theories 13. Non-abelian gauge theories ; 14. The standard model ;
Pedagogical methods :	Lectures and Tutorials
Prerequisites :	1. Lagrangian formulation of classical systems of point particles 2. Non-relativistic quantum mechanics : Heisenberg and Schrödinger pictures time-independent and time-dependent perturbation theory. Quantization of the Harmonic Oscillator in terms of raising and lowering operators 3. Fourier transforms ; Complex analysis (contour integration in the complex plane, Cauchy theorem)
Modalities of knowledge assessment :	Written examination at mid-term and at the end of the semester for the first session and Oral examination for second session (for the second session, the maximum grade is limited to 10)
Bibliography :	1. Peskin-Schroeder, “An introduction to Quantum Field Theory” 2. Schwartz , “Quantum Field Theory and the Standard Model”