Basic/Essential Course Information	
Course title	Quantum Field Theory
Degree Course title	Physics
ECTS	6
Compulsory attendance	YES
Course teaching language	ENGLISH

Teacher	Saverio Pascazio	saverio.pascazio@uniba.it

ECTS Details	**Disciplinary area/broad field:**	SSD	ECTS
		FIS/02	6

Time management and teaching activity type	Period	Year	lesson type
	1st semester	1st	Lessons (40h) Laboratory (15h)

Time management,	Total hours	in-class/in-lab study hours	out-of-class study hours
	150	55	95

Course calendar	Starting date	Ending date
	September	December

Syllabus	
Prerequisites	Quantum Mechanics, Mathematical Methods for Physics
Expected learning outcomes (according to Dublin Descriptors)	**Knowledge and understanding:** Acquire critical thinking, creativity, analytical ability. Understand physical phenomena and focus on their precise formulation. Understand the meaning of the mathematical (most concise) description of the physical world. **Applying knowledge and understanding:** Define objectives, benchmarks, learning targets and standards. Apply the powerful methods of theoretical physics to other fields and disciplines. Acquire the ability to judge correctness. Become aware of methods and tools of investigation. Stimulate and direct collaborative learning and individual understanding. **Making judgements:** Judge the value of acquired knowledge and methods. Estabilish evaluation criteria and standards, both quantitative and qualitative. Compare, contrast, distinguish, describe and finally identify physical phenomena. **Communication:** Grasp communication accurately, become able to adopt different and alternative forms of presentation. Master physics and science communication. Make examples that are not misleading and

	hinder scientific understanding. **Lifelong learning skills:** Reorganize material in summary, with central meaning and crucial points. Translate, interpret, extrapolate and view relationships. Continuously update scientific knowledge. Ask the right questions.
Course contents summary	Lagrangian Field Theory. Klein-Gordon Field. Dirac Field. Electromagnetic Field. Covariant Theory. S-Matrix.
detailed syllabus	**Photons and the Electromagnetic Field.** Particles and Fields, The Electromagnetic Field in the Absence of Charges, The classical field, Harmonic oscillator, The quantized radiation field, The Electric Dipole Interaction, The Electromagnetic Field in the Presence of Charges, Classical electrodynamics, Quantum electrodynamics, Radiative transitions in atoms, Thomson scattering. **Lagrangian Field Theory.** Relativistic Notation, Classical Lagrangian Field Theory, Quantized Lagrangian Field Theory, Symmetries and Conservation Laws. **The Klein-Gordon Field.** The Real Klein-Gordon Field, The Complex Klein-Gordon Field, Covariant Commutation Relations, The Meson Propagator. **The Dirac Field.** The Number Representation for Fermions, The Dirac Equation, Second Quantization, The spin-statistics theorem, The Fermion Propagator, The Electromagnetic Interaction and Gauge Invariance **Photons: Covariant Theory.** The Classical Fields, Covariant Quantization, The Photon Propagator. **The S-Matrix Expansion.** Natural Dimensions and Units, The S-Matrix Expansion, Wick's Theorem.
books	Franz Mandl & Graham Shaw, *Quantum Field Theory (second edition)* (John Wiley and Sons, 2010). S. Weinberg, *The Quantum Theory of Fields 1: Foundations* (Cambridge Univ. Press, 2005). Walter Greiner & Joachim Reinhardt, *Field quantization* (Springer Verlag, 1997)
notes	Selected chapters + course lecture notes
Teaching methods	Lectures, exercises, comments on methodology
Assessment % of final mark	100% Oral examination
Evaluation criteria	Knowledge of the principles and patterns of quantum field theory and comprehension of the facts and methods of quantum physics.