INSTITUTO DE FÍSICA
FACULTAD DE FÍSICA

COURSE	:	**QUANTUM FIELD THEORY II**
TRANSLATION	:	TEORÍA CUÁNTICA DE CAMPOS II
NUMBER	:	FIM3120
CREDITS	:	15 UC/ 9 SCT
MODULES	:	2 THEORETICAL LECTURES
REQUISITES	:	FIM3406
CONECTOR	:	AND
RESTRICTION	:	030401 AND 030501
CHARACTER	:	OPTATIVE
FORMAT	:	THEORETICAL LECTURES
QUALIFICATION	:	STANDARD
FORMATIVE LEVEL	:	MAGISTER
DISCIPLINE	:	PHYSICS

I.COURSE DESCRIPTION

This course deals with different aspects of Quantum Field Theory. After a review of the QED renormalization program, in the one loop approximation, formal aspects such as the Wightman axioms, the Lehmann Representation, and the LSZ procedure are addressed, which allows us to connect the elements of matrix S with functions of Green from theory. Next, the functional integral method is described in Field Theory. The Fadeev-Popov determinant for non-Abelian Gauge theories is presented in detail and Gribov's ambiguity is discussed. Finally, the renormalization group is studied, and the solution to the Callan-Symanzik equation. These ideas are applied to the asymptotic freedom of Quantum Chromodynamics via the calculation of the beta function.

II.LEARNING OUTCOMES

Familiarize the student with formal and phenomenological aspects of Quantum Field Theory and introduce them to recent techniques: functional method and the renormalization group. At the end of this course, the student will be able to develop research topics in this area.

III.CONTENT

1.Renormalization of QED to a loop.
1.1. Lagrangiando from QED
1.2. Primitively divergent diagrams
1.3. Dimensional regularization
1.4. Pauli-Villars regularization
1.5. Ward identities
1.6. Renormalization schemes
1.7. Renormalized Lagrangian.

2 formal aspects
2.1. Wightman Axioms
2.2. Matrix S
2.3. Lehmann spectral representation
2.4. LSZ Reduction Formulas

3.Quantization by functional integral
3.1. Quantum Mechanics and integrals on the way
3.2. Grassmann variables
3.3. Functional perturbation theory in quantum mechanics

3.4. Functional quantization of a scalar field theory
3.5. Quantization of Yang-Mills Fields
3.6. Determinant of Faddeev-Popov
3.7. Gribov's ambiguity

4. Renormalization Group
4.1. Callan-Symanzik equation
4.2. Beta function
4.3. Anomalous dimensions
4.4. Asymptotic freedom of the QCD

IV.METHODOLOGICAL STRATEGIES

-The course is evaluated through a set of tasks and presentations of current topics by students

V.EVALUATIVE STRATEGIES

-Two partial tests (67%)
-Homework (33%).

VI.BIBLIOGRAPHY

REQUIRED

Bjorken-D., Relativistic Quantum Field Theory, McGraw-Hill, 1964

Das, A., Quantum Field Theory, Word Scientific, 2008.

Nair, V. P, Quantum Field Theory: A Modern Perspective, Springer Verlag 2005

Itzykson, C. and Zuber, J.B., Quantum Field Theory, Dover, 2006.

Ramond, P., Field Theory (A modern Primer) Frontiers in Physics Ser. Vol. 74. Westview Press, 2001.

Ryder, L.H., Quantum Field Theory, 2nd Ed., Cambridge University Press, 1996

Weinberg, S., The Quantum Theory of Fields, Vol I y II, Cambridge University. Press, 1996.

OPTIONAL

N/A