



**INSTITUTO DE FÍSICA**  
FACULTAD DE FÍSICA

COURSE	:	<b>MANY BODY THEORY, SUPERCONDUCTIVITY AND MAGNETISM</b>
TRANSLATION	:	TEORÍA DE MUCHOS CUERPOS, SUPERCONDUCTIVIDAD Y
MAGNETISMO		
NUMBER	:	FIM3407
CREDITS	:	15 UC / 9 SCT
REQUISITE	:	FIZ0411, FIZ0412
CONECTOR	:	AND
RESTRICTIONS	:	030501
CHARACTER	:	OPTATIVE
FORMAT	:	THERETICAL LECTURES
QUALIFICATION	:	STANDARD
FORMATIVE LEVEL	:	DOCTORATE
DISCIPLINE	:	PHYSICS

**I. COURSE DESCRIPTION**

This course discusses the formalism of many-particle quantum mechanics in the context of condensed matter. The elements of the non-relativistic quantum field theory used to describe systems of many particles with interactions, at zero temperature and at finite temperature, are formulated; Using this formalism, systems of interest in condensed matter are studied, such as the Fermi liquid, superconductivity, the Kondo effect, among others.

**II. LEARNING OUTCOMES**

1. Know the fundamentals of non-relativistic quantum field theory used to describe systems of many particles with interactions, at zero temperature and at finite temperature.
2. Analyze the applications of contemporary techniques of quantum field theory in condensed matter physics and in Statistical Mechanics.

**III. CONTENT**

Second quantization: bosons, fermions.  
Zero temperature formalism: Green's functions, perturbation theory and Dyson's equation  
Concept of self-energy, Lehmann representation and quasiparticles  
Finite temperature formalism: Matsubara frequencies.  
Linear response and Kubo relations  
Case studies: Fermi and Bose liquids. Thomas-Fermi approximation. Electron-phonon and polaron interaction; BCS theory in superconductivity; Kondo effect.

**IV. METHODOLOGICAL STRATEGIES**

Lecture classes  
Homework  
Oral presentation

**V. EVALUATIVE STRATEGIES**

Homework 80%  
Presentation 20%



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**VI. BIBLIOGRAPHY**

**REQUIRED**

Negele, J. W., Orland, H. Quantum Many-Particle Systems, Westview.  
Fetter, A. L., Walecka, J. D. Quantum Theory of Many-Particle Systems, Dover.  
Mahan, G. Many-Particle Physics, Kluwer Academic Press.  
Altland A., Simons, B. Condensed Matter Field Theory, Cambridge Univ. Press.

**OPTIONAL**

N/A