INSTITUTO DE FÍSICA
FACULTAD DE FÍSICA

COURSE	:	**ADVANCES STATISTICAL MECHANICS**
TRANSLATION	:	MECÁNICA ESTADÍSTICA AVANZADA I
NUMBER	:	FIM8451
CREDITS	:	15 UC / 9 SCT
REQUISITES	:	FIZ0412, FIZ0411
CONECTOR	:	AND
RESTRICTIONS	:	030401, 030501
CHARACTER	:	OPTATIVE
FORMAT	:	THEORETICAL LECTURES
QUALIFICATION	:	STANDARD
FORMATIVE LEVEL	:	MAGISTER
DISCIPLINE	:	PHYSICS

I. COURSE DESCRIPTION

This course will discuss phase transitions and critical phenomena, in classical and quantum systems, using advanced tools such as path integrals, field theory, and group renormalization. The techniques used to extract the critical exponents in some systems in condensed matter will be described.

II. LEARNING OUTCOMES

1. Familiarize the student with advanced concepts of critical phenomena and phase transitions, both in classical systems and in quantum systems
2. Learning quantum theory methods of applied fields in Statistical Mechanics

III. CONTENT

1.- Critical phenomena
- 1.1- Introduction: Classic spin systems, Ising model, mean field theory, correlation functions.
- 1.2- Landau's theory of phase transitions
- 1.3- Wilson renormalization group
- 1.4- Critical exponents to order ε

2.- Field theory methods in Statistical Mechanics
- 2.1- Path integrals: classical Brownian motion, Feynman integral
- 2.2- Path integrals in coherent states and applications in Statistical Mechanics and quantum theory of many bodies.
- 2.3- Correlation functions and perturbation theory
- 2.4- Renormalization group and Callan-Symanzik equations.
- 2.5- Critical exponents to the second order in perturbation theory.

IV. METHODOLOGICAL STRATEGIES

Lecture classes
Homework
Oral presentation

V. EVALUATIVE STRATEGIES

Controls (80%)
Oral presentation (20%)

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VI. BIBLIOGRAPHY

REQUIRED

1. M. Le Bellac, “Quantum and Statistical Field Theory”, Oxford University Press (1991).
2. C. Itzykson and J.-M. Drouffe, “Statistical Field Theory ”, Vols. I, II. Cambridge University Press (1989).
3. J. Zinn-Justin, “Quantum Field Theory and Critical Phenomena” 4th Ed. Oxford University Press (1989).
4. J. W. Negele and H. Orland, “Quantum Many-Particle Systems”. Westview Press (1998).
5. E. Fradkin, “Field Theories of Condensed Matter Physics”, 2nd. Ed. Cambridge University Press (2013).

OPTIONAL

N/A