INSTITUTO DE FÍSICA
FACULTAD DE FÍSICA

COURSE	:	**ADVANCED TOPICS IN PLASMA PHYSICS**
TRASLATION	:	TÓPICOS AVANZADOS EN FÍSICA DE PLASMAS
NUMBER	:	FIM4013
CREDITS	:	15 UC / 9 SCT
MODULES	:	2 THEORETICAL
REQUISITES	:	FIZ2700
CONECTOR	:	AND
RESTRICTIONS	:	030401, 030501
CHARACTER	:	OPTATIVE
FORMAT	:	THEORICAL LECTURES
QUALIFICATION	:	STANDARD
FORMATIVE LEVEL	:	DOCTORATE
DISCIPLINE	:	PHYSICS

I. COURSE DESCRIPTION

The course presents advanced formal contents for the theoretical description of plasmas, both in the macroscopic framework characterized by the magnetohydrodynamic equations and in the statistical description given by the Kinetic Theory, as well as for the generation and characterization of different types of plasmas.

II. LEARNING OUTCOMES

- Provide the graduate student with advanced theoretical training in Plasma Physics.

III. CONTENT

1. Statistical treatment of a plasma: Vlasov Equation, Boltzmann Equation, Moments of Boltzmann Equation.
2. Macroscopic equations for the description of a plasma: MHD equations, Applicability of MHD equations, Generalized Ohm's law
3. Ideal magnetohydrodynamics: static equilibrium, MHD stability, energy principle, exchange instabilities, Rayleigh-Taylor instability
4. Resistive magnetohydrodynamics: magnetic relaxation and reconnection, resistive instabilities, magnetic field generation, MHD shocks.
5. Non-collisional kinetic theory: Vlasov equation, Landau damping, micro instabilities.
6. Collisional Kinetic Theory: transport coefficients, Fokker-Planck equation.
7. Plasma spectroscopy: equilibrium models (LTE, PLTE, MCE, CRM), Saha equation, ionization energy reduction, emission line profile, Doppler broadening, emission and absorption in lines and bremsstrahlung, Thomson scattering, Stark broaching
8. Laser-generated plasmas: laser gas breakdown, laser-target interaction plasma generation, dynamics of laser-generated plasmas

IV. METHODOLOGICAL STRATEGIES

- Lecture classes.
- Bibliographic research.

V. EVALUATIVE STRATEGIES

- Two interrogations70%.

- Exhibition work 30%.

VI. BIBLIOGRAPHY

Minimum

- Chen F., "Introduction to Plasma Physics and Controlled Fusion" (Third Ed., Springer, 2016).
- Boyd, T.J. and Sanderson, J.J., "The Physics of Plasmas", Cambridge University Press, 2005.
- Smirnov, B.M., "Physics of Ionized Gases", John Wiley & Sons, 2001.
- Gurnett D. A. and Bhattacharjee A., "Introduction to Plasma Physics: With Space, Laboratory and Astrophysical Applications", Cambridge University Press, 2017.
- Moisan M. and Pelletier J., "Physics of Collisional Plasmas", Springer, 2012.
- Miyamoto, K., "Fundamentals of Plasma Physics and Controlled Fusion", NIFS, 2000.
- Echkin V. N., "Spectroscopy of Low Temperature Plasa", Wiley-VHC, 2008.
- Eds. Hipper R., Hersten H., Schmidt M. and Schoembach, "Low Temperature Plasmas", Vols 1 &2, Wiley-VCH, 2008.
- Radziemski L. J. and Cremers D. A. (Eds.), "Lasers-Induced Plasmas and Applications", CRC Press, 1989

Complementary

- Smirnov, B.M., "Physics of Weakly Ionized Gases", Mir, 1981.
- Fridman, A and Kennedy, L.A., "Plasma Physics and Engineering", Taylor & Francis, 2004.
- . Dobrowolny, "Advanced Plasma Physics", e-book, Youcanprint, 2019.