INSTITUTO DE FÍSICA
FACULTAD DE FÍSICA

COURSE	:	**CLASSICAL OPTICS**
TRANSLATION	:	ÓPTICA CLÁSICA
NUMBER	:	FIM8350
CREDITS	:	15 UC / 9SCT
MODULES	:	2 THEORETICAL LECTURES, 2 LABORATORIES
REQUISITES	:	FIZ0312
RESTRICTION	:	030401, 030501
CHARACTER	:	Minimum
QUALIFICATION	:	STANDARD
DISCIPLINE	:	PHYSICS

I. COURSE DESCRIPTION

This course introduces modern optical techniques from a theoretical and experimental perspective. During the course topics that allow the understanding of common optical components in laboratories and optical effects such as; metallic and dielectric mirrors, beam splitters, polarizers, optical fibers, Kerr, Pockels, Faraday effects, among others. Additionally, modern perspectives of the wave phenomenon of light are introduced such as Gaussian and Fourier optics, and classical coherence theory, in order to provide the student with better tools both for the theoretical understanding of optical phenomena, and for their use in experimental laboratory problems.

II. LEARNING OUTCOMES

The objective of this course is the students' theoretical understanding of optical components and phenomena, as well as the strengthening of basic laboratory skills such as component manipulation and system calibration. Both objectives are presented in a complementary way, so that students can apply the theory in experiments, such as understanding the theory according to their laboratory experiences.

III. CONTENT

1 Metal mirrors
- 1.1 Optical properties of metals
- 1.2 Skin effect or skin effect
- 1.3 Complex refractive index
- 1.4 Hagen-Rubens relationship
- 1.5 Kramers-Kronig relations
- 1.6 Experiment 1: Reflectivity of metals

2 Gaussian rays
- 2.1 Paraxial Helmholtz equation
- 2.2 Gaussian rays
- 2.3 Complex ray parameter q
- 2.4 Kogelnik's Law ABCD
- 2.5 Experiment 2: Gaussian beam profile

3 Anisotropic media

3.1 Symmetric dielectric tensor
3.2 Main axes
3.3 Ellipsoid of indices
3.4 Wave retarder
3.5 Normal surface and birefringence angle
3.6 Uniaxic and bioxic crystals
3.7 Polarizers based on birefringence
3.8 Stress birefringence
3.9 Experiment 3: Photoelasticity

4 Effects: Pockels, Kerr, Photorefractive and Faraday
4.1 Pockels effect and Pockels cell
4.2 Kerr effect and Kerr cell
4.3 Photorefractive effect and spatial solitons
4.4 Faraday effect, optical isolator and Faraday rotator

5 Dielectric mirrors
5.1 Fabry-Pérot interferometer, Etalon, Gires – Tournois etalon
5.2 Total internal reflection frustrated (Waveguide coupler, Dichroic filter)
5.3 Bragg reflector

6 Diffraction
6.1 Kirchhoff's diffraction theory
6.2 Diffraction gratings
6.3 Rayleigh-Sommerfeld diffraction theory
6.4 Experiment 4: Spectrometer

7 Fourier optics
7.1 Babinet's principle
7.2 Spatial filtering of images with the 4f system
7.3 Schlieren photography
7.4 Experiment 5: Fourier optics

8 Optical fibers
8.1 Chromatic losses and dispersion in optical fibers
8.2 Single-mode and multi-mode fibers (LP modes, cut-off frequency and intermodal dispersion)

9 Consistency
9.1 Temporal, spatial and monochromatic coherence
9.2 The Wiener-Khintchine theorem
9.3 The van Cittert-Zernike theorem

IV. METHODOLOGICAL STRATEGIES

Lectures and laboratory experiences.

V. EVALUATIVE STRATEGIES

Homework (50%),
Laboratory reports (50%)

VI. BIBLIOGRAPHY

REQUIRED

E. Hecht, "Optics" (5ed)

G. R. Fowles, "Introduction to Modern Optics" (2ed)

M. Born, E. Wolf, "Principles of Optics" (7ed)

B.E.A. Saleh, M.C. Teich, "Fundamentals of Photonics" (2ed)

A.E. Siegman, "Lasers"

W.T. Silfvast, "Laser Fundamentals" (2ed)

T. Scharf, "Polarized Light in Liquid Crystals and Polymers"

OPTIONAL

N/A