Electromagnetic optics and photonics

Academic Year: (2023 / 2024) **Review date: 01-09-2023**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: ACEDO GALLARDO, PABLO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

None

OBJECTIVES

The objective of this course is, on the one hand, to review the fundamental concepts of electromagnetic optics (from the classical point of view) as a starting point for the concepts of quantum optics that will be taught later and, on the other hand, to review the fundamental photonic components used in quantum engineering technologies (lasers, detectors, ...).

DESCRIPTION OF CONTENTS: PROGRAMME

- - Electromagnetic waves: superposition, reflection, refraction, diffraction, interference and polarization.
- - Propagation of EM waves in free space, waveguides and optical fibers.
- - Semi-classical model for light-matter interaction. Absorption, Spontaneous emission and stimulated emission.
- - Lasers. Properties of laser light: spectral and spatial coherence. Laser types (gas, solid state, semiconductor, quantum cascade, optical fiber, etc). Pulsed lasers.
- - Photodetectors. Responsivity and noise. Detection limits. Heterodyne detection.
- - Photodiodes, photomultipliers, CCDs, photon counters.

LEARNING ACTIVITIES AND METHODOLOGY

Leraning activities:
AF1 Theoretical class
AF2 Practical classes
AF3 Theoretical and practical classes
AF4 Laboratory practices
AF5 Tutorials
AF7 Individual student work
AF8 Partial and final exams
Teaching methodologies:
MD1 Class lectures by the professor with the support of computer and audiovisual media, in which the main concepts of the subject are developed and the bibliography is provided to complement the students' learning.
MD2 Critical reading of texts recommended by the professor of the subject: articles, reports, manuals and/or academic articles, either for later discussion in class, or to expand and consolidate the knowledge of the subject.
MD3 Resolution of practical cases, problems, etc. .... posed by the teacher individually or in groups.

ASSESSMENT SYSTEM

The continuous assessment will consist of:

1.- Team project 20%
2.- Laboratory report 20%

Final exam 60%

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Bahaa E. A. Saleh, Malvin Carl Teich Fundamentals of Photonics, Wiley, 2007

ADDITIONAL BIBLIOGRAPHY

- F.X. Kaertner Fundamentals of Photonics. 6.602(UG)/6.621(U) Course Notes, MIT, 2009