Electrooptic Systems

Academic Year: (2023 / 2024) **Review date: 12-04-2023**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: SANCHEZ PENA, JOSE MANUEL

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Fundamentals of Electronic Engineering

OBJECTIVES

At the end of the course the students should be able to:
1.- Have the coherent knowledge of the branch of Photonics.
2.- Have the ability to apply their knowledge and understanding to identify, formulate and solve optoelectronic problems using established methods.
3.- Have ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements.
4.- Have the ability to conduct searches of literature, and to use data bases and other sources of information.
5.- Have the ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
6.- Have the ability to select and use appropriate equipment, tools and methods.
7.- Have the ability to combine theory and practice to solve engineering problems.
8.- Understand applicable techniques and methods, and their limitations.
9.- Work effectively as an individual and as a member of a team.

DESCRIPTION OF CONTENTS: PROGRAMME

M0: Chromogenic materials
-0.1 Electro-optical effects: transmission, reflection, scattering, absorption, etc.
Principle
-0.2 operation of electrically activated chromogenic materials:
- Liquid crystals: properties and types
- Electrochromics: properties and types
- Electrophoretics: properties

-0.3 Applications in different environments: displays, bioengineering, automotive, etc.

M1: Optical sources: LED and laser
- 1.1. Introduction.
- 1.2. Types of emitters: LEDs and lasers.
- 1.3: Working principle of optical emitters based on semiconductors.
- 1.4: LED: Efficiencies. Electrical and optical characteristics curves
- 1.5: LASER. Efficiencies. Electrical and optical characteristics curves

M2: Propagation, attenuation and dispersion in optical fibers
- 2.1. Introduction: Physical structure, operating principle.
- 2.2. Propagation, singlemode / multimode character.
- 2.3: Attenuation, transmission windows.
- 2.4: Dispersion: Intermodal, color, PMD. Limiting the bandwidth and distance.

M3: Optical detectors
- 3.1. Introduction: symbol and characteristic curves of photodiodes.
- 3.2. Conditioning circuits.
- 3.3: Structure and working principle.
- 3.4: Types of optical detectors.
- 3.5: Noise considerations in optical detectors.

M4: Optical components for processing photonic signal
- 4.1: routers, couplers, filters, MUX/DEMUX, etc
-4.2: optical amplifiers: SOA, EDFA, etc.

M5: optical communications links
- 5.1. Elements of an optical communications link.
- 5.2. Power budget.
- 5.3: Time budget. Bandwidth

M6: E/O systems applications
-6.1 Study case 1: practical resolution
-6.2 Study case 2: practical resolution

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures, classes to solve problems in small groups, tutorials and personal work, oriented to the acquisition of knowledge (3 ECTS).
- Lab (4 sessions) and classes of problems in small groups, individual tutorials and personal work, oriented to the acquisition of practical skills related to the program of the course (3 ECTS).

ASSESSMENT SYSTEM

Continuous assessment based on tests assessing skills and knowledge, laboratory controls, thematic and individual student work. The following weights to each of the above tests will be assigned:
- Individual exam of thematic block: 35% of the final grade
- Experimental group project : 35% of the final grade
- Final exam (required): 30% of the final grade

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- J.A. Castellano "Handbook of Display Technology", Academic Press, San Diego, (1992)
- M.A. Karim Ed "Electro-optical Displays", Marcel Dekker Inc, New York, (1992)
- R.P. Khare Fiber Optics and Optoelectronics , Oxford, 2004

ADDITIONAL BIBLIOGRAPHY

- Max Born & Emil Wolf Principles of Optics, Pergamon Press, 1984