Major Unit – Advanced Photonics Technologies (5 ECTS) RADMEP/UJM semester 3

Course instructors: Ass. Prof. Adriana Morana, Prof Sylvain Girard, Prof Emmanuel Marin and external RADMEP guest lectures /Language of instruction: English

Overview

This lecture has the main objective to introduce the most advanced technologies that are implemented or are considered for implementation in radiation-rich environments. Among the various existing technologies, a focus will be given on the following technologies that are of direct interest in the framework of RADMEP:

1. Introduction to the Physics of Guided Optics and Optical Fibers
2. Optical fiber-based sensors and lasers
3. Image Sensors and Detectors
4. Photonic Integrated Circuits and Silicon Photonics
5. Optoelectronic - Photonic components and systems:

In addition to the classroom lectures, homeworks allow exploiting the acquired knowledge will be done. As an example, for the part 1, the effective index method introduced during the lecture will be exploited to solve two practical problems. The first one concerns the realization of a single-mode planar waveguide in the 1260 – 1550nm range of wavelengths using a manufacturing technology that makes it possible to manufacture buried step index waveguides of limited width. The second one concerns the design of an asymmetrical planar waveguide allowing to transmit a 532 nm signal while filtering a parasitic signal at 1064 nm. Part of these exercises will consist in developing some Matlab routines allowing to solve the characteristic equation for these structures allowing to identify the number of modes and their associated propagation constants.

Learning outcomes

On successful completion of this course, students should have the skills and knowledge to:

- Know theoretical basis and conditions of use of the various Advanced Photonics Technologies
- Identify, measure and calculate the main parameters defining the performances of those Advanced Photonics Technologies
- Model the responses of those technologies versus their definition parameters.

The homeworks using the software Matlab or other softwares will focus on the following skills:

- Know and use basic functions and commands of those softwares
- Define, simulate and analyze simple photonic problems using the state-of-the-art methods

Teaching methods

- Lectures and exercises : 45 hours
- Significant part of the lectures and homeworks will be given by external RADMEP guest lecturers specialists of those topics

Assumed knowledge

- Bases of electromagnetism
- Bases of geometrical optics (from Optical Engineering Module)
- Bases of semi-conductor physics

Evaluation criteria

- For lectures: written exam
- For homeworks: written assignments