

IS2210

Optical fibers and optoelectronics

Professor: Pierre Lecoy

Language of instruction: French – **Number of hours:** 36 – **ECTS:** 3

Prerequisites: B.Sc. level in general mathematics and physics. Basics of wave propagation, semi-conductors, and signal processing

Period: S8 Elective 12 March to June IN28IE5, SEP8IE5

Course Objectives

Understanding the physical principles, technology, and practical use of optical fibers, of opto-electronic and integrated photonic components and devices. Review of the applications in the fields of communications and networks, show the diffusion of these technologies in the fields of imaging, scientific and medical instrumentation, lightning, energy. Be able to make choice and dimensionning fitted to the applications. Discover the research topics and industrial aspects.

On completion of the course, students should be able to

- ✧ understand the theoretical and technological basis, and the vocabulary
- ✧ choose the components and devices best suited to a given application
- ✧ apply simple design and dimensionning rules
- ✧ know and use laboratory equipments (OTDR, optical spectral analyser, tools for optical fibers)
- ✧ be aware of professional facts

Course Contents

Optical fibers, theory and practical use (3 sessions incl. exercises) :

- ✧ propagation theory over multimode and single-mode fibres
- ✧ dispersions, attenuation, birefringence, non-linear effects
- ✧ technology (manufacturing, connecting), new structures (photonic bandgap fibers)
- ✧ measurements on fibers, reflectometry (OTDR)

Components (3 sessions incl. exercises):

- ✧ optical components (splitters, wavelength division multiplexers, Bragg gratings, modulators, switches), principles of photonic integrated circuits
- ✧ opto-electronic components (principles and materials ; LED, laser diodes, photodiodes, semi-conductor and doped fiber optical amplifiers)
- ✧ applications : displays (LCD, plasma panels, OLED), image sensors, photovoltaic cells, LED lighting, fiberoptic sensors

2 sessions of laboratory demonstrations and practical works : use of optical fibers, reflectometry, optical amplifiers, fiber links, optoelectronic components, photovoltaic cells

Fiberoptic transmission and networks (2 sessions including a case study)

III-V semiconductors technologies, industrial and research aspects : 1 visit at III-V lab, Palaiseau

Course Organization

- ✧ 8 lectures including exercises and case study
- ✧ 1 cvisit
- ✧ 2 labs (demonstrations and practical work)
- ✧ 1 session devoted to student presentations (final evaluation)

Teaching Material and Textbooks

- ✧ Lectures slides in french and english
- ✧ "Fiber-Optic Communications", P. Lecoy, Wiley, 2008
- ✧ Reference books in French and English available from the library

Resources

Lecturers :

- ✧ Pierre LECOY, Professor, CentraleSupélec

Practical sessions will take place at LISA (under organisation constraints)

Evaluation

Partial exam on the case study (1/3 of the grade)

Final exam (2/3 of the grade) : student's presentations on current topics in research and development or use of opto-electronic technologies.