# **Optical Systems and Networks**

- 1. Course number and name: 020SYOES4 Optical Systems and Networks
- 2. Credits and contact hours: 4 ECTS credits, 2x1:15 contact hours.
- 3. Instructor's or course coordinator's name: Elias Rachid, Melhem El Helou
- 4. Instructional materials: course handouts; lab experiments

#### **References:**

- Pierre Lecoy, Communications sur fibres optiques, 4<sup>ème</sup> édition, 2014.
- John M. Senior, Optical Fiber Communications: Principles and Practice, 3<sup>rd</sup> edition.
- 2009.
- Rajiv Ramaswami, Kumar N. Sivarajan, et Galen H. Sasaki, Optical Networks A Practical Perspective, 3<sup>rd</sup> edition, 2010.

## 5. Specific course information

## a. Catalog description:

This course covers the fundamentals of optical communications (with emphasis on signal degradation mechanisms in optical fibers); passive and active optical components; optoelectronic transmitters; optoelectronic receivers; WDM concepts and technologies; optical amplifiers; design of optical transmission systems; optical networks: access networks, optical transport networks, and wavelength routing networks.

- **b. Prerequisites:** 020EMCNI3 Electromagnetism or 020EMECI3 Electromagnetism
- **c. Required** for CCE Telecommunication Networks option students; **Selected Elective** for CCE Software Engineering option students.

### 6. Educational objectives for the course

- a. Specific outcomes of instruction:
  - Understand the fundamentals of optical communications.
  - Analyze optical communication systems.
  - Compute and interpret optical link budgets.
  - Design and compare optical transmission systems.
  - Analyze optical network architectures and characteristics.

## b. PI addressed by the course:

PI	1.1	1.2	1.3	2.1	2.2	2.4	6.1	6.2	6.4
Covered	X	X	X	X	X	X	X	X	
Assessed	X	X	X	X	X	X	X	X	X

## 7. Brief list of topics to be covered

- Fiber types, index profile, numerical aperture, multimode and gradient single-mode fibers, index radius, left-radius light propagation (2 lectures)
- Wave propagation in optical fibers: field expressions for TE, TM, HE and EH modes (2 lectures)
- Attenuations and dispersions in optical fibers (2 lectures)
- Optoelectronic transmitters (1 lecture)
- Optoelectronic receivers (1 lecture)
- Optical fiber systems: point-to-point fiber links (2 lectures)
- Lab experiments (2 lectures)
- Optical components: couplers, isolators, circulators, WDM multiplexer/demultiplexer couplers, add and drop multiplexers, optical crossconnect (OXC), regenerative repeaters, and optical amplifiers; optical network architecture (3 lectures)
- Optical fiber systems: amplified links and WDM links (3 lectures)
- Optical access networks: FTTx architectures, passive optical networks, and active optical networks (3 lectures)
- Optical transport networks (SDH/SONET networks) and wavelength routing networks (2 lectures)
- IP in all-optical networks optical switching networks: optical circuit-switched networks, optical packet-switched networks, and optical burst switching networks (1 lecture)