Optical Systems and Networks

1. **Course number and name:** 020SYOES4 Optical Systems and Networks

2. **Credits and contact hours:** 4 ECTS credits, 35 contact hours + 2:30 lab hours

3. **Instructor's or course coordinator's name:** Elias Rachid and Melhem El Helou

4. **Text book:**
   a. **Other supplemental materials:**
      Course handouts; lab experiments

5. **Specific course information**
   a. **Catalog description:**
      Fiber optics - index profile - wave propagation in optical fibers - EH Field expressions and modes - attenuations, dispersions, and wavelength windows - LASER and LED diodes - optical sources and detectors - optical passive and active components - optical amplification - optical fiber systems: point-to-point fiber links, amplified links, and WDM links - optical networks: access networks, optical transport networks, and wavelength routing networks.

   b. **Prerequisites:** 020EMCNI3 Electromagnetism or 020EMECI3 Electromagnetism

   c. **Required:** Elective for CCE students; required for CCE telecommunication networks option students

6. **Specific goals for the course**
   a. **Specific outcomes of instruction:**
      Describe the fiber optics, TE, TM, HE and EH modes
      Understand the index profile, the propagation of the waves in the fibers
      Analyze and calculate the EM field expressions, attenuations
      Investigate losses, attenuations and wavelength windows
      Determine the optimum optical fiber
      Study LASER emitting diodes, PIN and PDA photodiodes and optical receivers
      Understand the basic principles of optical communications
      Compute and interpret optical power link budgets
      Design and compare optical systems
      Analyze optical network architectures and characteristics

   b. **KPI addressed by the course:**

KPI	a1	a2	b2	b3	c1	c2	e3	k2
Covered	x	x	x		x	x	x	x
Assessed	x	x	x	x	x	x	x	x
Give Feedback								

7. **Topics and approximate lecture hours:**

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 fibers (2 lectures).

Laser Diode (3 lectures).

Light emitting diode (1 lecture).

Photodiodes and receivers: PIN, PDA, optical receivers, signal-to-noise ratio (1 lecture).

Optical fiber systems: point-to-point fiber links (3 lectures).

Lab experiments (2 lectures).

Optical components: couplers, isolators, circulators, WDM multiplexer/demultiplexer couplers, add and drop multiplexers, optical cross-connect (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 (4 lectures).

IP in all-optical networks – optical switching networks: optical circuit-switched networks, optical packet-switched networks, and optical burst switching networks (1 lecture).