

EC524- Optical Communications

CREDIT HOURS

3 Hours

CONTACT HOURS (Hours/week)

Lecture: 2; Tutorial: 2; Lab: 2

COURSE COORDINATOR

Dr. Ashraf Mamdouh

TEXT BOOK

Jhon M. Senior, "Optical Fiber Communications: Principles and Practice". 3rd ed., 2009.

COURSE DESCRIPTION

Optical Communications: Elements and System

PREREQUISITE:

EC 422

RELATION OF COURSE TO PROGRAM

Elective

COURSE INSTRUCTION OUTCOMES

The student will be able to:

- Discuss Theory of light propagation in different types of optical fibers.
- Overview of optoelectronic device requirements for communication systems, including light sources, optical amplifiers and light detectors.
- Design of a complete high data rate optical communication system.
- Understand the principal components in the optical communication system, including: optical fibers, light sources, optical amplifiers and light detectors.
- Understand optical transmission and reception.
- Construct and adjust a high capacity and minimum loss optical communication system using different multiplexing techniques.

TOPICS COVERED

- Historical Development: Historical background on communications, communication channels, light sources and detectors, General optical communication system. Advantages of optical fiber communications.
- General problems in communications including: Radio (AM and FM), Telephone and Television systems.
- Optical Fiber Waveguide: Ray theory transmission, Fiber acceptance angle and numerical aperture, Fiber types: step index – graded index – single mode – multimode.
- Handling optical fibers.

- Electromagnetic Theory for Optical Propagation – Normalized frequency of the optical fiber, Linearly polarized modes in optical fibers.
- Transmission Characteristics in Optical Fibers: Polarization, Attenuation: absorption, scattering, bending and microbending.
- Transmission Characteristics in Optical Fibers: Dispersion: definition and types – Bit rate calculation, Material dispersion, Waveguide dispersion.
- Transmission Characteristics in Optical Fibers: Dispersion management in single-mode optical fibers, Intermodal dispersion, Overall dispersion and fiber coupling.
- Fiber Fabrication – Fiber Cable Design – Fiber Connection.
- Fiber Connection: Directional couplers: Types and definitions, Fiber splicing: permanent and nonpermanent joints.
- Connectors and splices + Problems on: Directional couplers
- Fiber Misalignment: Types of misalignment, Joint loss.
- Light Sources: Requirements, Concept of light emission (spontaneous- stimulated) - LED operation.
- Laser: Operation, Cavity, Injection laser diode, Light source limitations.
- Fiber Laser - Optical Amplifiers: Concept and types - Light Detectors: Requirements.
- Light Detectors: Photodiode: Operation, Quantum efficiency, Responsivity, Response time.
- Optical Fiber Communication Systems: Rise time, Adjustment, Power budget – Rise time budget), Multiplexing techniques (TDM – WDM – SDM).
- Introduction to Modulation: Analog and Digital.

CONTRIBUTION OF COURSE TO MEET THE REQUIREMENTS OF CRITERION 5:

Professional component Content			
Math and Basic Sciences	Engineering Topics	General Education	Other
	✓		

RELATIONSHIP OF COURSE TO STUDENT OUTCOMES:

Student Outcomes	Course aspects	
A	An ability to apply knowledge of mathematics, science, and engineering	a ₁ a ₂
B	An ability to design and conduct experiments, analyze and interpret data.	
C	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability	c ₃
D	An ability to function on multi-disciplinary teams.	
E	An ability to identify, formulate, and solve engineering problems	
F	An understanding of professional and ethical responsibility	
G	An ability to communicate effectively	
H	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social content	
I	A recognition of the need for, and an ability to engage in life-long learning.	i ₁ i ₂ i ₃
J	A knowledge of contemporary issues within and outside the electrical engineering profession.	
k	An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	