

Faculty of Engineering & Technology

Optical Electronics

Information :

Course Code : ELE 412

Level : Undergraduate

Course Hours : 3.00- Hours

Department : Specialization of Electronics & Communication

Instructor Information :

Title	Name	Office hours
Associate Professor	KAMEL MOHAMED MAHMOUD HASSAN	2
Assistant Lecturer	MOHAMED MOUSA SAYED EMAM AHMED	4

Area Of Study :

- Develop the students' knowledge about the principles of operation of photonic components.
- Develop the students' knowledge about optical and photonic components.
- Prepare students to analyze the photonic components.
- Perform the basic calculations of optical sources and optical detectors.
- Train students to perform basic experiments on optical and photonic components.

Description :

Introduction, Photons & Electrons. Maxwell's equations, Wave nature of light, Fundamentals of Optics. Interaction of radiation and atomic systems, particle/wave property, De-Broglie wave length, Uncertainty principle, Optical Coherence and Correlation. Radiation and Solids: Light and matter (light propagation in uniform dielectric medium, Rayleigh scattering, susceptibility, optical dispersion), rate equations and gain medium for two level system. Theory of laser oscillation: Fabry-Perot laser, Three-level System. Four-level System. Optical Sources- Gas Laser, Nd-YAG Laser, Semiconductor sources (LEDs & LDs). Optical Modulators. Photo detectors (PINs & APDs).

Course outcomes :

a.Knowledge and Understanding: :

1 -	Review the main concepts of geometrical optics and Quantum theory.
2 -	Explain the theory of semiconductor materials and their optical properties.
3 -	Explain the operating principles of LEDs, Lasers, SLDs, and optical detectors.
4 -	Review the fundamentals of optical and photonic devices.

b.Intellectual Skills: :

1 -	Analyze the main parameters related optical and photonic components.
2 -	Examine the basic parameters of photonic devices.
3 -	Compare of the different types of the used optical sources and detectors in optical fiber communications.

c. Professional and Practical Skills: :

1 -	Follow-up safety requirements at work.
2 -	Edit a professional technical report.
3 -	Interpret carefully the data sheets of optical and photonic devices.
4 -	Build-up experimental set-up to test the basic parameters of the optical component and photonic devices.

d. General and Transferable Skills: :

1 -	Demonstrate a self-directed manner.
2 -	Show the ability to work coherently and successfully as a part of a team.
3 -	Manage time and meet deadlines.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Introduction, Photons & Electrons. Maxwell's equations, Wave nature light, Emission of and Absorption processes.	5	3	2
Fundamentals of Optics, Ray optics: reflection, refraction, critical and Brewster angles. Interference of light, Interferometers, Diffraction and Polarization.	10	6	4
Light and matter: Emission, Propagation and Absorption Processes.	10	6	4
Optical Coherence and Correlation: Definition, Measurement of coherence and Practical examples.	5	3	2
Essential Physics of Radiation and Solids: Black body radiation, Classical results and Quantum results. Rate Equations and the Gain mechanism. Laser Structure, Mode locking and Q switching.	10	6	4
Electrons in solids: Laser sources (He=Ne Laser, Argon Laser and ND-YAG Laser), SC sources (LEDs and SLDs)	10	6	4
Optical Modulators: Internal modulation, External modulators: Electro optic, Magneto optic and Acousto-optic modulator.	10	6	4
Photo detectors: photo-emissive, photoconductive and photovoltaic detectors.	5	3	2
Testing of the basic characteristics of optical sources, detectors, and optical components.	10	6	4

Teaching And Learning Methodologies :

Interactive Lecture
Discussion
Problem Solving
Experimental Learning
Cooperative Learning
Research
Project

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
• Final exam	40.00		
Lab test	10.00		
Mid- Exam I	15.00		
Mid- Exam II	15.00		
Participation	10.00		
Quizzes	10.00		

Recommended books :

"Fundamentals of Photonics" Bahaa E. A. Saleh, Malvin Carl Teich.