

EC539- Opto Electronics

CREDIT HOURS

3 Hours

CONTACT HOURS (Hours/week)

Lecture: 2; Tutorial: 2

COURSE COORDINATOR

Dr. Khaled Shehata

TEXT BOOK

S.O. Kassap, OPTOELECTRONICS and PHOTONICS: PRINCIPLES & PRACTICES, Prentice Hall

COURSE DESCRIPTION

Light Radiation: Concept of light emission (spontaneous and stimulated), Laser and Light Emitting Diode (LED): structure, operation, characteristics, limitations, analog and digital modulators.

Photodetectors: Concept of light detection, Photodiode: structure, operation, characteristics, efficiency, responsivity, response time.

Optical Amplifiers: Semiconductor optical amplifier (SOA), Fiber amplifiers,.

Light Wavelength Converters: Concept, types, applications.

Fiber Bragg Grating (FBG): Concept, types, applications.

Fabrication of Optical Devices: Fabrication processes: Laser, LED, photodetectors, fiber Bragg grating.

PREREQUISITE:

EC233

RELATION OF COURSE TO PROGRAM

Elective

COURSE INSTRUCTION OUTCOMES

The student will be able to be familiar with the theory and applications of optical devices.

TOPICS COVERED

- Principles of: Light absorption, radiation, reflection and refraction, Optical properties of semiconductors, Injection and radiative recombination
- Laser Basic concepts, absorption and emission of radiation, population inversion, optical feedback and laser oscillation, threshold condition for laser oscillation

- Optical emission from semiconductor, semiconductor injection laser, single-mode operation.
- Nonsemiconductor lasers, Nd:YAG laser, glass fiber laser, narrow-linewidth and wavelength-tunable lasers, modulator.
- LED Construction, operation, parameters and characteristics, carrier injection and spontaneous emission, internal and external radiative efficiencies.
- Performance, current characteristics, response time, advanced LEDs: heterojunction LED, edge-emitting LED, surface emitting LED.
- LED characteristics, output power, output spectrum, reliability, modulator, modulation bandwidth.
- Photodetector (1): Optical detection principles, direct and indirect absorption, quantum efficiency, responsivity, response time.
- Photodetector (2): Photoresistor, semiconductor photodiode: construction operation, characteristics.
- Semiconductor Optical Amplifier (SOA): Theory, performance characteristics, applications.
- Fiber and Waveguide Amplifiers: Rare-earth-doped fiber amplifiers, Raman fiber amplifier. Waveguide amplifiers, optical parametric amplifiers, wideband fiber amplifiers.
- Fiber Bragg Grating (FBG): Theory, types, applications.
- Wavelength Conversion: Cross-gain modulation wavelength converter, cross-phase modulation wavelength converter, cross-absorption modulation wavelength converter, coherent wavelength converters.
- Fabrication of Some Optical Devices: Laser, LED, photodiode, fiber Bragg grating.

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	
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 ₁ c ₂ c ₃
D	An ability to function on multi-disciplinary teams.	
E	An ability to identify, formulate, and solve engineering problems	e ₁ e ₂ e ₃
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.	
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.	k