

# ECE 441: Optical Electronics

IN

## Mathematics Concepts

- Calculus
- Matrix algebra

## Physics Concepts

- Electromagnetic waves
- Waveguides
- Basic geometric optics laws
- Diffraction
- Interference

## Pre-requisites

- ECE 342 with a C or higher

## Concepts:

- Review of geometric Optics
- Optical resonators
- Stability criteria for optical resonators
- Transverse and longitudinal modes in optical resonators
- Light-matter interaction
- Einstein coefficients
- Optical gain, population inversion
- Three and four levels systems
- Semiconductor lasers: principles and characteristics; single mode semiconductor lasers; vertical cavity surface emitting lasers
- Light emitting diodes
- Optical detectors: signal to noise considerations
- Pin photodiodes
- Photoelectric effect and photomultipliers
- Charge couple device detectors
- Principles of optical waveguides

## Applications:

- Optics communications and design of an optical data link

## Tools:

- MATLAB - Optional

OUT

## Building Blocks of Optoelectronic Systems

- Know the fundamental concepts and devices that are the building blocks of lasers
- Know the fundamental concepts and devices that are the building blocks of detectors
- Know the fundamental concepts and devices that are the building blocks of fiber optics

## Optical Electronics Design and Experimentation

- Identify, formulate and solve engineering problems
- Apply engineering design process to produce solutions that meet specified needs
- Develop and conduct appropriate experimentation, analyze and interpret data
- Design a high bit rate optical data link using commercially available components