Electrical and Computer Engineering Department
ECE 441 Optical Electronics

Elective course for Computer Engineering, Elective for Electrical Engineering, Required for Lasers and Optics

Course credits: 3

Catalog Description: The course covers the fundamental aspects of lasers and light emitting diodes, optical resonators, optical waveguides, and detectors. It shows how these components can be used to design optoelectronic systems.

Prerequisites: ECE 341, ECE 342, Electromagnetics

Textbook: Class notes provided by the instructor

Course Objectives: To become familiar with fundamental concepts and devices that are the building blocks of optoelectronic systems, including lasers, detectors, and optical fibers.

Topics covered:

1. Review of geometric optics, optical matrixes
2. Optical resonators
3. Stability of optical resonators
4. Transverse and longitudinal modes
5. Light-matter interaction. Einstein A and B coefficients
6. Optical gain, population inversion
7. Three and four laser level systems
8. Lasers: examples of gas lasers(He-Ne, Argon lasers)
9. Solid lasers: (Nd YAG, Ruby laser, Ti:Sapphire laser)
10. Review of p-n junction.
11. Semiconductor lasers: principles and characteristics; single mode semiconductor lasers; vertical cavity surface emitting lasers.
12. Light emitting diodes
13. Optical detectors: signal to noise considerations
14. PIN photodiodes
15. Photoelectric effect and photomultipliers
16. Charge couple device detectors
17. Principles of optical waveguides
18. Optical fiber characteristics; fiber losses, multi mode dispersion, chromatic dispersion
19. Fiber amplifiers
20. Principles of optics communications and design of an optical data link.

Evaluation methods:

1. Midterm exam: 30%;
2. Final Project (design of a high bit rate optical data link using commercially available components; paper and in-class oral presentation): 30%;
3. Final: 40%

Class/laboratory schedule: This course meets for three 1 hour lecture sessions per week.

Contribution of course to meeting the professional component: Utilizes concepts of classical and modem physics, and mathematics, to achieve an understanding of the building blocks of optoelectronic systems. The components are used to design some optoelectronics systems such a digital data link.