ELEC4620 Photonics and Optical Communications

Course Description

To introduce optoelectronics and fiber optics for communications. Topics include optical fibers, optical sources, optical detectors, and passive components for wavelength-division multiplexing. Laboratory gives hands-on experience in handling optical fibers, lasers and detectors, micro-optical components, opto-mechanical equipment, and building wavelength-division-multiplexed optical links. *Prerequisite(s):* ELEC 3600

List of Topics

Lecture 1: Overview of Photonics and Optical Fiber Communications
Lecture 2: Ray theory transmission in optical fibers
Lecture 3: Wave optics in waveguides
Lecture 4: Electromagnetic theory for optical waveguiding
Lecture 5: Transmission characteristics of optical fibers – fiber modes and attenuation
Lecture 6: Transmission characteristics of optical fibers – fiber dispersion
Lecture 7: Light-matter interactions and optical transitions
Lecture 8: Laser fundamentals
Lecture 9: Selected topics from semiconductor physics for photonics
Lecture 10: Semiconductor optical sources - light-emitting diodes
Lecture 11: Semiconductor optical sources – laser diodes
Lecture 12: Photodiodes
Lecture 13: Wavelength-division multiplexing (WDM) components and systems

Statement of Objectives/Outcomes:

On completion of this course, students will be able to:

CO1 - Develop fundamental understanding of photonics in the context of optical communications

CO2 - Acquire hands-on experience to photonics and optical communications

CO3 - Strengthen communication skills via writing bi-weekly lab reports, writing and presenting project proposals and final papers

CO4 - Understand the current development in photonics and optical communications via lectures, projects and optional literature readings

Textbook(s):

No required textbook.

Reference Books:

1. Gerd Keiser, *Optical Fiber Communications*, 4th or 5th edition
2. John M. Senior, *Optical Fiber Communications*, 3rd or the latest edition
3. Joseph C. Palais, *Fiber Optic Communications*, 5th or the latest edition
4. Yariv and Yeh, *Photonics – Optical electronics in modern communications*, 6th edition
5. Saleh and Teich, *Fundamentals of Photonics*, 2nd edition
6. Jia-Ming Liu, *Photonic Devices*
7. Govind P. Agrawal, *Lightwave Technology – Components and Devices*
8. Govind P. Agrawal, *Lightwave Technology – Telecommunication Systems*

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework	10%
Lab reports	30%
Project	30%
Final Examination	30%