SPRING 2016

SEMICONDUCTOR LASERS AND PHOTODETECTORS
ESE519

SUNY at Stony Brook
Department of Electrical and Computer Engineering

Prerequisite: BS in Physical Sciences or Electrical or Computer Engineering.
3 credits

Instructor: Gregory Belenky

COURSE DESCRIPTION

The course provides an introduction to the design, characterization and fabrication techniques for semiconductor lasers and photodetectors.

Topics include the following: fundamentals of the LED, laser and detectors operation, devices band diagram, characteristics and testing technique for lasers as well as avalanche and PIN photodetectors.

Special attention is given to the device design and working characteristics.

COURSE TOPICS

1. Fundamentals of the lasers operation: population inversion and optical feedback.
2. Active media review.
4. Semiconductor laser band diagram. Concept of the pinning of the carrier concentration at the threshold.
5. Parameters of the semiconductor laser: threshold current and device characteristic temperature, external and internal device efficiency, optical gain and losses, laser differential gain.
7. Basic lasers characterization technique. Measurement LI and IV characteristics in pulsed and CW regimes. Hakki Paoli technique to measure laser gain.
9. Laser emission: far and near field emission patterns. Methods of the lateral optical confinement in edge emitting devices: strong and weak index guided and gain guided semiconductor lasers.

10. Quantum well lasers. Design lasers with strain.

11. Design of high-speed telecommunication lasers.


15. Digital and analog optical transmitters for telecommunications. Lasers for pumping of erbium doped fiber amplifiers (EDFA).


18. Light absorption in semiconductors. Thermal and quantum detectors.
