OPTI 240: Semiconductor Physics and Lasers
Instructor: Mahmoud Fallahi
fallahi@optics.arizona.edu
Spring Semester

- Introduction to Semiconductor Optoelectronic
- Introduction to quantum mechanics: Energy, momentum, Uncertainty Principle, Schrödinger wave equation, potential well
- Atoms and Solids: Pauli exclusion principle
- Metal, Insulator, Semiconductor
- Conduction band, valance band, energy gap
- Electrons and holes
- Various semiconductors: IV, III-V, II-VI
- Direct and indirect band
- Intrinsic, extrinsic (P and N doping): e⁻- hole concentration, Fermi level
- Carrier Transport

--------------------------------------- First Exam -----------------------------------------------
- P-N Junction: equilibrium potential, space charge, current-voltage
- Metal-Semiconductor Schottky contact, ohmic contact
- Heterojunction
- Light absorption and light emission, spontaneous vs. stimulated process
- Photoconductor, Photodiodes, Photovoltaic solar cells
- Light emitting diodes

----------------------------------------Second Exam -----------------------------------------
- Waveguides: Snell’s law, TIR
  Semiconductor Lasers: Inversion of population, gain, amplification, lasing condition, Fabry-Perot Lasers, threshold gain, spectrum, L-I characteristics
- Multimode and single mode Lasers
- Quantum well lasers
- Other types of Photonic components: optical amplifiers, Modulator

---------------------------------------- Final Exam ----------------------------------------

Grading:
- Attendance: 5 %
- Homework: 10 %
- First Exam: 25 %
- Second Exam: 30 %
- Final Exam: 30 %

Required Book: Semiconductor Physics and Devices: Basic Principles, Author: Donald A. Neamen, Publisher: McGraw-Hill.
Recommended Book: Semiconductor Optoelectronic Devices, Author: Pallab Bhattacharya, Publisher: Prentice Hall.