OPTI 341: Semiconductor Physics and Lasers
Instructor: Mahmoud Fallahi
Fall 2022
https://wp.optics.arizona.edu/opti341/

- Why Semiconductors? Various semiconductors: IV, III-V, II-VI
- Solids and crystal structures
- 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
- Direct and indirect band
- Intrinsic, extrinsic (P and N doping)
- Distribution Functions and Fermi Energy
- Intrinsic Carrier concentration

--------------------------------------- First Exam -----------------------------------------------
- Extrinsic Carrier Concentration: Majority and Minority Charges
- Carrier Transport
- P-N Junction: equilibrium potential, space charge, current-voltage
- Heterojunction
- Metal-Semiconductor contact
- Semiconductor-Light interaction: Absorption, Spontaneous vs Stimulated Emission

---------------------------------------- Second Exam ----------------------------------------
- Photoconductor, Photodiodes, Photovoltaic solar cells
- Light emitting diodes
- Waveguides: Snell’s law, TIR
- Semiconductor Lasers: gain, lasing condition, Fabry-Perot Lasers, L-I characteristics
- Multimode versus single mode Lasers

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


Recommended Books:
Semiconductor Optoelectronic Devices, Author: Pallab Bhattacharya, Publisher: Prentice Hall.
Essential of photonics: Author: Alan Rogers, CRC Press

Grading:
- Attendance: 3 %
- Homework: 12 %
- First Exam: 25 %
- Second Exam: 30 %
- Final Exam: 30 %