OPTI 341: Semiconductor Physics and Lasers

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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** ----------

Required Book: Semiconductor Physics and Devices: Basic Principles, 4th Edition, Author: Donald A. Neamen, Publisher: McGraw-Hill.

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 %