

ECE304 Introduction to Photonics Fall 2023

Prof. Kent Choquette
3108 Micro and Nanotechnology Building
choquett@illinois.edu

Description: Introduction to active and passive photonic devices and applications: optical processes in semiconductor and dielectric materials including electrical junctions, light emission and absorption, and waveguide confinement; photonic components such as light emitting diodes, lasers, photodetectors, solar cells, liquid crystals, and optical fiber; optical information distribution networks and display applications. The cellular phone and the associated information distribution systems introduce and motivate the study of photonic devices.

Wiki: <https://wiki.illinois.edu/wiki/display/ECE304FA23>

See "Lectures and Notes" for slides, reading assignments, and homework.

Supplementary texts: R. Quimby, *Photonics and Lasers; An Introduction* (Wiley 2006)
R. Pierret, *Semiconductor Device Fundamentals* (Addison Wesley 1996)

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|-----------------|----------------------|----------|-------------------------------|
| Grading: | Homework | 20% | Due one week after assigned |
| | Three exams in-class | 20% each | Sept. 22 Oct. 25 Dec. 4 |
| | Final Exam | 20% | Dec. 15 @ 1:30-4:30 pm |

Syllabus:

- 1) Introduction
 - Photonics in smart phones
 - Information networks
 - 2) Electrons in solids
 - Energy bands
 - Charge carriers
 - 3) Interaction between light and semiconductor
 - Absorption
 - Emission
- Exam 1*
- 4) Semiconductor P/N junctions
 - Built-in potential
 - Energy bands with forward & reverse bias
 - 5) Diode photonics: detectors
 - Photodetectors
 - Solar cells
 - 6) Diode photonics: emitters
 - LEDs
 - White lighting & display
- Exam 2*
- 7) Semiconductor laser diodes
 - Lasing threshold
 - Light confinement
 - 8) Optical fiber
 - Optical modes and V-parameter
 - Fiber loss & dispersion
 - 9) Optical networks:
 - Modulation & multiplexing
 - Photonic integrated circuits

Exam 3

Comprehensive Final Exam