**ECE304 Introduction to Photonics Fall 2023**

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**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/diplay/ECE304FA23](https://wiki.illinois.edu/wiki/diplay/ECE304FA23)  
See “Lectures and Notes” for slides, reading assignments, and homework.

**Supplementary texts:**  
R. Quimby, *Photonics and Lasers; An Introduction* (Wiley 2006)  

**Grading:**  
- Homework: 20%  
  Due one week after assigned
- Three exams in-class: 20% each  
  - Exam 1: Sept. 22  
  - Exam 2: Oct. 25  
  - Exam 3: 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**