

16:332:592 Optoelectronics II

Contemporary Topics in Optoelectronics/Photonics

Spring 2008

Instructor: Dr. Wei Jiang

Time: MW 5:00-6:20 PM

Classroom: ARC-205

Office Hours: MW 4-5pm (or by appointment), EE 215

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Prerequisites: Electromagnetic waves, and semiconductor physics or solid state electronics or optoelectronics I (please contact the instructor if you are not sure).

Course Description: This course is intended to introduce current research topics in optoelectronics and photonics. Four topics for this year: (1) Photonic crystals: basic physics, fabrication (including nanoimprint), and integrated devices (cavities, waveguides, lasers, modulators, demultiplexers, sensors, negative index materials); (2) Selected topics in plasmonics; (3) Selected topics in silicon photonics; (4) Selected topics in ZnO based devices.

Grading: Some of the research papers and reports will be given as "supplemental reading". About five assignments: 2 regular homework assignments and 2~3 two-page summaries of research papers, and a term paper and presentation.

Week-by-Week Syllabus

Week 1: Photonic bands and bandgaps

Week 2-3: Photonic crystal slabs and waveguides and cavities

Week 4: Photonic crystal surfaces: transmission/coupling,

Week 5: Fabrication of photonic crystals: Electron beam lithography, etching, nanoimprint

Week 6: Holography, two-photon absorption(direct write), DUV, colloidal assembly & templating

Week 7: Photonic crystal lasers and LEDs

Week 8: Photonic crystal modulators

Week 9: Spring break, no class.

Week 10: Photonic crystal superprism based demultiplexers and sensors

Week 11: Photonic crystal cavities and optical filters

Week 12: Surface plasmon excitations: basic physics, waveguiding.

Week 13: Negative index materials (photonic crystals or metamaterials), and subwavelength imaging or superlensing; Plasmonic nano-antenna; surface-plasmon enhanced Raman scattering

Week 14: Silicon photonics: overview. High-speed silicon modulators, and silicon lasers

Week 15: Silicon Raman amplifiers. **Term paper presentation**

Textbooks (just for references, all materials will be covered in lectures notes and posted on the course website <http://sakai.rutgers.edu>)

- W. Jiang and M. L. Povinelli, "Photonic crystals: physics, fabrication and devices," book chapter for Springer *Nanostructure Science and Technology Series*. To appear in 2008.
- D. L. Lockwood and L. Pavesi (ed.), "Silicon Photonics," Springer Topics in Applied Physics, vol. 94, 2004. ISBN: 3-540-21022-9.
- A list of reference books and research papers will be given throughout the lectures.