ECEN 5626 Active Optical Devices

Department of Electrical and Computer Engineering
University of Colorado at Boulder
Spring 2011

Objective
The course is designed to help students gain complete understanding of active optical devices by clearly defining and interconnecting the fundamental physical mechanism, device design principles and device performance.

Instructor
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Lecture Hours
3:00 – 3:50 pm, MW, ECEE 1B28
Office Hours
TBA

Prerequisite
Undergraduate-level semiconductor device course (ECEN 3320 or equivalent) is required but may be exempted by instructor consent. Graduate level semiconductor device course (ECEN 5355 or equivalent) will be a plus.

Homework
2 sets of homework will be given out during the Semester. Solutions will be available after homework is collected and graded.

Examinations
2 mid-term exams will be given during the semester.

Grading
15% - Homework (∗ 2)
20% - Mid-Term Exam (∗ 2)
30% - Term Paper

References
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Tentative Course Schedule

Week 1 – 4.
- Overview of Course and Expectations
- Fundamentals of Semiconductor Physics
- Semiconductor-Based Active Optical Devices
  - Light-emitting diode
  - Solid state lighting device
  - Laser diode

Week 5.
- Exam 1 (Feb. 11)

Week 6 – 9.
- Solar cell
- Semiconductor photodiode
- Avalanche photodiode
- Flat panel display technologies
  - Classification, display design criteria, human vision, etc.

Week 10.
- Exam 2 (Mar. 18)

Week 11.
- Spring break

Week 12 – 15.
- Flat panel display technologies
  - Liquid crystal display
  - Electroluminescent display
    - Inorganic EL display
    - Organic EL display
    - Organic solar cell
  - Plasma display panel

Week 16.
- Term paper presentations
Suggested Term Paper Topics

Term paper should be a short review on state of the art of the technologies related to the following subjects:

- Semiconductor light emitting diode
- Semiconductor laser diode
  - III-V compounds: GaAs, GaN, InP, etc.
  - II-VI compounds: ZnSe, ZnS, ZnTe, MgCdTe, etc.
- Quantum well/wire/dot structures
- Vertical cavity surface emitting laser
- Solid state lighting device
- Solar cell
  - Silicon-based solar cell, Thin film solar cell, Organic solar cell, Third-generation solar cell
- Photodetector
  - Si MOS structure
- Charge coupled device (CCD)
- Avalanche photodiode
- Photoconductor
- Liquid crystal display
  - Novel liquid crystals, Thin film transistors
- Electroluminescent display
  - Thin film deposition techniques
- Plasma display panel
- Plasma gas characteristics
- Field emission display
  - Field emitter tip fabrication, Field emission characteristics
- Other topics may also be allowed upon instructor consent.

Term paper must be written according to a professional journal format (e.g. IEEE journals, Physical Review Letters or Journal the Optical Society of America). Begin with a brief but informative title followed by abstract, text, and references. Text should contain introduction and conclusion/summary at the beginning and end, respectively. Maximum length is 6 pages and students are asked to consult the instructor if the length limit cannot be met. Figures/tables should be placed within the text close to where they are cited or discussed.

Abstract is due Feb. 4 and term paper is due Apr. 22.

Students are also requested to prepare a presentation on the term paper subject. Presentations will be given on Apr. 25 – 29.
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Disability
If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and www.Colorado.EDU/disabilityservices

Religious Observance
Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, students with religious obligations that may cause conflicts with the course proceeding are requested to talk to the instructor within the first two weeks of the semester. See full details at http://www.colorado.edu/policies/fac_relig.html

Classroom Behavior
Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at http://www.colorado.edu/policies/classbehavior.html and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code
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