UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering and Computer Sciences

EECS 232: LIGHTWAVE DEVICES

http://www.eecs.berkeley.edu/~wu/ee232/
Fall 2006

Prof. Ming C. Wu
261M Cory Hall, (510) 643-0808, wu@eecs.berkeley.edu

LECTURES

Tuesday and Thursday – 9:30 to 11:00 am in 293 Cory

OFFICE HOUR

Thursday – 11:00 to 12:00 noon in 261M Cory

TEXTBOOK

S.L. Chuang, *Physics of Optoelectronic Devices*, John Wiley and Sons, 1995

REFERENCES (On reserve at the Engineering Library)

- Yariv & Yeh, *Photonics: Optical Electronics in Modern Communications*, Oxford University Press, 2006
- Coldren & Corzine, *Diode Lasers and Photonic Integrated Circuits*, John Wiley & Sons, 1995
- Saleh & Teich, *Fundamentals of Photonics*, John Wiley & Sons, 1991 [This is a great introductory textbook for a quick review of materials you are not familiar with.]

SIMULATION SOFTWARE

- RSoft LaserMOD (http://web1.rsoftdesign.com/products/component_design/LaserMOD/)

COURSE OBJECTIVE

- Develop a physical understanding of optoelectronic devices, including light-emitting diodes, semiconductor lasers, photodetectors, modulators;
- Acquire basic skills for analyzing and designing semiconductor optoelectronic devices.

PREREQUISITES

- EECS 130 or equivalent: Simple pn-junction, semiconductor physics, concept of energy bands, Fermi levels.
- PHYS 137A: recommended. Basic concept of quantum mechanics, perturbation theory
- EECS 117: recommended. Concept of dielectric waveguide, electromagnetic waves.

HOMEWORK

Homework will be assigned every Thursday and due the following Thursday in class. Discussion and collaboration, as opposed to copying, is encouraged. In other words, you can discuss the homework with your classmates but you must write your own derivations and do your own calculations.

EXAM & GRADES

Homework	30%
2 Midterms	20% + 20%
Final Exam	30%

EECS Department Policy on Academic Dishonesty:
http://www.eecs.berkeley.edu/Policies/acad.dis.shtml

TOPICS AND SCHEDULE

#	Week of	Topics
1	8/28	Introduction to Optoelectronics (Chap. 1) Maxwell’s equations (§2.1); Semiconductor electronics (§2.2);
2	9/4	<9/4: Labor Day> Basic quantum mechanics, square potential well (§3.1, 3.2);
3	9/11	Time-dependent perturbation theory; Fermi’s Golden Rule (§3.7); **<9/14: No class>**
4	9/18	Optical absorption (§9.1); Interband absorption and gain (§9.3)
5	9/25	**<9/26: No class>** Absorption and gain in quantum well structures (§9.4);
6	10/2	Intersubband absorption (§9.6); Double heterostructure lasers (§10.1);
*	10/5	<**Midterm #1** on 10/5 evening, 6:00 – 7:30 pm>
7	10/9	Optical waveguides, dispersion relations (§7.1, §7.6); Gain-guided and index-guided lasers (§10.2)
8	10/16	Quantum-well lasers (§10.3); Strain effects on band structures (§4.5);
9	10/23	Strained quantum-well lasers (§10.4); Distributed feedback lasers (§8.6 and §10.6);
10	10/30	**<10/31: No class>** Vertical cavity surface-emitting lasers (§10.7);
11	11/6	Direct modulation of semiconductor lasers (§11.1); Rate equations
*	11/8	**<Midterm #2** on 11/8 evening, 6:00 – 7:30 pm>
12	11/13	Franz-Keldysh effect and excitons (§13.2, 13.3); Quantum confined Stark effect (§13.4); Electroabsorption modulators (§13.5);
13	11/20	Photodetectors (§14.1); p-i-n photodiodes (§14.2, 14.3); <11/23: Thanksgiving Day>
14	11/27	Avalanche photodiode (APD) (§14.4) Intersubband photodetectors (§14.5)
15	12/4	Review/Discussions
*	12/6	**Final Exam** in the evening of 12/6 [6-9 pm]