ECE 475 – INTRODUCTION TO ELECTRO-OPTICS AND OPTOELECTRONICS

Semester: Spring 2015
Class Time: M-W 2:00pm-3:15pm
Class Location: CHTM Room 103

Instructor:
Professor Daniel Feezell
Electrical & Computer Engineering Department
E-mail: dfeezell@unm.edu
Office Location: CHTM Room 112B
Office Hours: After class or by appointment

Class Website:
http://www.unm.edu/~dfeezell/ECE475/
I will post the syllabus, homework assignments and solutions, lecture slides, and other course materials. The website requires you to login using your UNM NetID. A detailed course schedule is also available on the course website. This schedule includes the material to be covered, recommended sections of the book for reading, exam dates, and HW assignments and due dates. Please note that the schedule is approximate.

Topics Covered:
Wave Nature of Light (Ch. 1) – plane waves, phase velocity, wave equation, beam divergence, refractive index, dispersion, group velocity, group index, irradiance, Poynting vector, Snell's law, total internal reflection, Fresnel equations, AR coatings, DBRs, absorption, coherence, interference, cavities, diffraction.

Dielectric Waveguides and Optical Fibers (Ch. 2) – dielectric slab waveguides, step index optical fibers, numerical aperture, dispersion in fibers, bit rate, bandwidth, GRIN fibers, attenuation.

Semiconductor Science and Light-Emitting Diodes (Ch. 3) – review of (energy bands, Fermi statistics, DOS, doping, E-k diagrams, pn junctions), recombination lifetime, heterojunctions, LED basic principles, quantum well LEDs, LED materials and structures, internal and external quantum efficiency, light-extraction.

Stimulated Emission Devices: Optical Amplifiers and Lasers (Ch. 4) – stimulated emission, photon amplification, Einstein coefficients, EDFAs, threshold condition, gain, semiconductor diode lasers, differential efficiency, rate equations, transparency, gain curves, single frequency lasers, vertical-cavity surface-emitting lasers (VCSELs), semiconductor optical amplifiers (SOAs).

Photodetectors (Ch. 5) – pn photodiodes, photocurrent, absorption, detector materials, quantum efficiency, responsivity, pin photodiodes, avalanche photodiodes, solar cells.

*We will also have two guest lecturers given by researchers from Sandia National Laboratories during the semester. They will be Dr. Jonathan Wierer, who will discuss GaN-based LEDs and solid-state lighting, and Dr. Anna Tauke-Pedretti, who will discuss integrated infrared photonics.

Required Text:
"Optoelectronics and Photonics: Principles and Practices," S. O. Kasap, Pearson, 2nd edition (2013), ISBN-13: 978-0-13-215149-8.

Web Resources for Kasap Text:
If you purchased a legal copy of the 2nd edition, there are student web resources available. To access them, go to: http://optoelectronics.usask.ca/resources-all-readers/. The website explains how to find the required passwords.

Reference Texts:
"Semiconductor Optoelectronic Devices," P. Bhattacharya, Prentice Hall, 2nd edition (1997), ISBN-13: 0-13-495656-1

"Fundamentals of Photonics," B.E.A. Saleh and M.C Teich, Wiley, 2nd edition (2007), ISBN: 978-0-471-35832-9

Prerequisite:
ECE 371

Grading:

Homework (there will be approximately 6 homework assignments)	30%
Midterm Exam (Monday 3/16, 2:00-4:00pm, covers Ch. 1-3)	20%
Group Research Presentation (Wednesday 4/29, 2:00-4:00pm, more info on website)	20%
Final Exam (Wednesday 5/6, 3:00-5:00pm, covers Ch. 4-5)	30%

Homework Policy:
Late homework assignments will typically not be accepted as I will post the solutions to the assignments right after you turn them in. Homework is due at the *beginning* of the class period on the due date. Homework should be neatly written, with each problem labeled and the pages stapled together. Show your work in order to get maximum credit! If the problem says "plot" you should use Excel or Matlab, if the problem says draw or sketch, you can do it by hand.