ECE/PH 482/582: Optical Electronic Systems
Fall 2012

Instructor: Alan X. Wang, Ph.D.
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Office Hours: M,W 3:00-4:00pm or by appointment (e-mail me to set up a time)

Lab TA: Dihan Hasan <hasandihan@gmail.com> Office hours: TBA

Lecture Classes: MWF 2-2:50 pm in KEC 1005

ABET Learning Objectives:

Learn principles, analysis, and design of photodetector circuits, laser cavities, output beams, gain, transient effects, and optical electronic systems. Design, complete, test, and document a team optical electronic project. Read current technical optoelectronic literature with understanding.

Detailed Course Contents:

Week 1: Brief Introduction to lasers and photonics.
Week 2: Photodetectors
Week 3: Introduction to Lasers
Week 4: Energy States and Gain
Week 5: Optical mode properties
Week 6: The Fabry-Perot Cavity I
Week 7: The Fabry-Perot Cavity II
Week 8: Gain Saturation
Week 9: Transient Processes
Week 10: Optical fibers based on ray optics

Laboratory: Tuesday: 10-11:30am or 4:00-5:30pm in Dearborn 222 by the TA, ~3 hours (You only need to attend one session): demonstration and lab quizzes; lab group teams by sign-up during the week.

Five defined laboratories:

- Lab 1 Introduction to lab safety (Week 1)
- Lab 2 Characterization of photodetectors (Week 2)
- Lab 3 TEM_{00} Gaussian beam (Week 4)
- Lab 4 Laser transverse modes (Week 5)
- Lab 5 Longitudinal modes and FP interferometer (Week 7)

Each group (3-4 students) will be required to write up a short report answering the assigned questions for the lab experiment and commenting on what didn't work as expected. This is often where the real learning happens.

One final project: 3-week team design projects.

The lab project should be done in groups of 3-4 persons. It will include a project proposal, weekly written progress reports, a final written Project Report (1 per team), and demonstration to the instructor and/or lab TA and, hopefully, others in

the class also. The purpose of the project is to use the knowledge you have gained about optical waveguides and system components to design, fabricate, and test a working application or simulation.

Prerequisites: Vast enthusiasm and curiosity! Also, some knowledge of electromagnetic wave propagation and basic optics (lenses, reflection, and refraction) is helpful but not required.

Textbook: (Required) Kelin J. Kuhn, *Laser Engineering*, 1998, Prentice-Hall; ISBN 0-02-366921-7

Library Reserve: Amnon Yariv and Pochi Yeh, *Photonics: Optical Electronics in Modern Communications.,*
6^{th} *ed*, 2007, Oxford University Press; TA1520 .Y37 2007
[B.E.A. Saleh and M.C. Teich, *Fundamentals of Photonics, 2nd ed*, Wiley; 2007]

Lab References: (in the lab) Photonics Spectra, "Photonics Dictionary," [Book 4]
Photonics Spectra, "Photonics Handbook and Applications," [Book 3]
American Institute of Physics Handbook; plus various posters, books, manuals, etc.

Grading: Laboratory (quizzes (4/5), lab reports, and project) 25%; Homework (five homework) 20%; Midterm Exam 25%; Final Exam 30%.

Examination Midterm exam in class: 10/24/2012 2-3pm -- closed book / concepts / your own equation sheets
Final exam: TBA in the final week.