ELEC 425/ELEC 525/PHYS 525
PHOTONIC MATERIALS AND DEVICES
SPRING 2016

Class Meeting Location	ENG B18
Class Meeting Times	Tu, Th 16:00 – 17:15
Instructor	Şükrü Ekin Kocabaş
Office Hours	After class or by appointment
Office Location	ENG Z11
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Teaching Assistant
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Course Description

Survey of the properties and applications of photonic materials and devices; semiconductors; photon detectors, light emitting diodes, noise in light detection systems; light propagation in anisotropic media, Pockels and Kerr effects, light modulators, electromagnetic wave propagation in dielectric waveguides, waveguide dispersion; nonlinear optical materials, second harmonic generation, Raman converters.

Course Objectives

This course will further your knowledge on photonic devices by going over the fundamentals of semiconductor physics related to optics, properties of anisotropic materials, non-linear effects and noise issues.

Teaching Methods

Lectures will be made by using the board. At the end of each chapter, the relevant electrical/optical simulation program from Lumerical will be introduced. HWs will include analytical, numerical as well as simulation work. Final will be in the form of a report. Familiarity with Maxwell's equations and ability to write computer scripts is required.

Tentative Course Contents

Dates	Day	Week	Class No	Lecture	Notes
2-Feb-16	Tue	1	1	Intro	
4-Feb-16	Thu		2	Chp 7	**Semiconductors**
9-Feb-16	Tue	2	3	Chp 7	
11-Feb-16	Thu		4	Chp 7	
16-Feb-16	Tue	3	5	Chp 7	
18-Feb-16	Thu		6	Sim Overview	*Device Module*
23-Feb-16	Tue	4	7	Sim Overview	
25-Feb-16	Thu		8	Chp 10	**Dielectric Waveguides**
1-Mar-16	Tue	5	9	Chp 10	
3-Mar-16	Thu		10	Chp 10	
8-Mar-16	Tue	6	11	Chp 10	
10-Mar-16	Thu		12	Sim Overview	*Mode Solutions*
15-Mar-16	Tue	7	13	Sim Overview	
17-Mar-16	Thu		14	Chp 8	**Anisotropic Media**
22-Mar-16	Tue	8	15	Chp 8	
24-Mar-16	Thu		16	Chp 8	
29-Mar-16	Tue	9	17	Chp 8	
31-Mar-16	Thu		18	Sim Overview	*FDTD Solutions*
5-Apr-16	Tue	10	19	Sim Overview	
7-Apr-16	Thu		20	Chp 11	**Nonlinear Optics**
12-Apr-16	**Tue**	**11**		**Holiday**	Spring Break
14-Apr-16	**Thu**			**Holiday**	Spring Break
19-Apr-16	Tue	12	21	Chp 11	
21-Apr-16	Thu		22	Chp 11	
26-Apr-16	Tue	13	23	Chp 11	
28-Apr-16	Thu		24	Sim Overview	*FDTD Solutions*
3-May-16	Tue	14	25	Sim Overview	
5-May-16	Thu		26	Device Analysis	
10-May-16	Tue	15	27	Device Analysis	
12-May-16	Thu		28	Review	
TBA					Final Report due

Assessment Methods

Type	Description	Final Grade %
Homework	Analysis and simulation of optical devices	30
Midterm	Take-home midterm	30
Final Report	You will be asked to prepare a report that attempts to improve or re-design an optical device	40
Total		**100**

Reference Materials

- Pollock, C. R. 1995. Fundamentals of optoelectronics. Chicago: Irwin.
- Yariv, Amnon. 1989. Quantum electronics. New York: John Wiley & Sons.
- Yariv, A. 1997. Optical electronics in modern communications. New York, N.Y.: Oxford University Press.
- Saleh, Bahaa E. A. 1991. Fundamentals of Photonics (Second Edition). Wiley-Interscience.

Required TextBooks

- Sennaroglu, Alphan. 2010. Photonics and laser engineering: principles, devices, and applications. New York: McGraw-Hill.

Academic Dishonesty

You are encouraged to talk to your classmates about homework assignments and the class in general. For instance, if there is a concept that you need to understand in order to solve a homework problem or if there is a specific technique that you do not know well (i.e. an integration method) feel free to consult your fellow classmates. However, you are expected to do the work yourselves and copying of solutions is not allowed. Make sure you properly reference the work of others as well. Academic dishonesty, including plagiarism, cheating on exams or homeworks is a serious offence and will not be tolerated. University policies regarding this matter will be strictly enforced. Please read the section on academic dishonesty in the university catalog.

Particularly, since you will be writing reports and making presentations, proper referencing of external materials will be important. Make sure you read the following document regarding what constitutes plagiarism.

http://vpaa.ku.edu.tr/sites/vpaa.ku.edu.tr/files/Misc_Documents/Statement_on_Academic_Honesty.pdf