ELEC 438 / ELEC 538 Integrated Photonic Structures Syllabus

Class Meeting Time and Location: Tue/Thu 11:30 – 12:45 CASE B34

Instructor: Şükrü Ekin Kocabaş, ENG Z11, (212)338-1776, ekocabas@ku.edu.tr

Office Hours: After class or by appointment

Number of Credits: 3

Course Assistant: Tooba Khan — tkhan15@ku.edu.tr

Course Description: This course will introduce numerical and modeling tools used in the analysis of integrated optical devices. Topics include: dielectric slab waveguides, optical properties of metals, plasmonic waveguides, coupled mode theory, scattering matrices, numerical investigation of waveguide dispersion, time-domain simulations of wave propagation in waveguides, methods of extraction of scattering parameters from full-wave simulations, analysis of waveguide based WDM components.

Grading:

Take-home Midterm Exam 1 — %20
Take-home Midterm Exam 2 — %20
Final Project — %30
Homework — %30

Prerequisites: Working knowledge of Maxwell's equations, familiarity with Matlab.

Tentative Course Schedule: This semester we will have 28 lectures in 14 weeks.

Week	Topic
1	Overview, review of Maxwell's equations
2	Finite-differences, Yee algorithm
3	Incident wave conditions in FDTD
4	Analysis of multi-layer dielectric coatings
5	Absorbing boundary conditions
6	Dispersive materials
7	Review of dielectric slab waveguides and surface plasmons
8	Scattering matrix formalism
9	Coupled mode theory, waveguide-cavity coupling, waveguide-waveguide coupling
10	Overview of other numerical techniques used in photonics
11	Fiber bragg gratings, free-space to waveguide coupling structures
12	Wavelength division multiplexing devices, couplers, splitters
13	Ring resonators, modulators, detectors
14	Wrap-up, review

Textbook and other course material: "Computational Electrodynamics, The Finite-Difference Time-Domain Method," by Taflove & Hagness, Artech House (2005, 3rd Ed.) and also relevant papers from the literature. Additionally, we will use Lumerical's FDTD program, each student will get his/her own license for the duration of the course.