EECS 210 Applied Electromagnetic Theory

Fall 2006	**Office Hours**	**Prof. A. R. Neureuther,**
Tu, Th 12:30-2	**M, (W), 11AM**	**509 Cory Hall, 2-4590**
400 Cory	**Tu, Th, (F) 10AM**	**neureuth@eecs**

Syllabus

Catalog Description: Advanced treatment of classical electromagnetic theory with engineering applications. Boundary value problems in electrostatics. Applications of Maxwell's Equations to the study of waveguides, resonant cavities, optical fiber guides, Gaussian optics, diffraction, scattering, and antennas.

Goals for Fall 2006: 1) Establish a complete and efficient theoretical fundamental underpinning arising from Maxwell’s equations and use of Green’s identity including fundamental theorems and integral representations. 2) Understand the key steps in boundary value solution techniques using separation of variables with source matching and eigenfunction expansion techniques. 3) Formulate and analyze diffraction scattering and antenna radiation including assessing fundamental gain-bandwidth limits for small antennas and objects. 4) Develop techniques for analyzing guided wave and photonic systems including determining source free solutions (modes and plasmons), ω-β diagrams, wave coupling, analysis of periodic and photonic structures, and use of signal flow graph theory.

Approach for Fall 2006: The course will be primarily based on selected and reordered material from Chapters 1-10 of Jackson, “Classical Electrodynamics,” 3rd edition, Wiley, 1998. This text uses a very efficient representation, the theoretical developments are to the point, and useful analysis techniques are included. To emphasize concepts over properties of special functions, nearly all examples will be in Cartesian coordinates. To emphasize theoretical concepts and integral representation/equation approaches, the material involving the use of Green’s identity including reciprocity will be consolidated. To analyze guided wave and photonic systems additional material will be provided on wave dispersion diagrams, coupled mode theory, theory of small reflections, Floquet’s Theorem, and signal flow graph theory.

References of Interest: (on reserve in Engineering Library)

R.E. Collin, “Foundations of Microwave Engineering,” McGraw Hill, 1966, (Sm. Refl., Floquet)
T. Tamir Ed., “Integrated Optics”, Springer Verlag, 1979 (Kogelnik Guides, Tamir Couplers)
Hewlett-Packard Application Note No. 154, 1965. (Signal Flow Graph Theory)
A.B. Buckman, “Guided-Wave Photonics,” Saunders, 1992 (Coupled Optical Guides)
D.K. Lynn, Analysis and Design of Integrated Circuits,” Motorola, 1967. (Coupled T-lines)

Homework: There will be weekly homework (out Tu due Th of following week). The problems will be typically based on completing details of derivations in the text, demonstrating concepts in detail and extending the text material to emerging applications such as optoelectronics.

Project: Students are required to do an individual project related to an emerging application of electromagnetic theory. A short (8 min) web based presentation to the class is required near the end of the semester. The project will consist of describing the application with references, categorizing and summarizing the electromagnetic technique utilized, and critiquing the method and assessing potential extensions.

Midterm: (tentative) Tu, October 24th, (9th Week material from weeks 1-7).

Final Exam: Monday, December 18th, 12:30-3:30pm, (mostly material from weeks 8-14).

Grading: Homework: 15%; Class Participation and Project: 15%; Midterm: 35%; Short Final Exam: 35%; Please read the EECS Departement Policy on Collaboration and Cheating