EECS412-Electromagnetic Field Theory III
Prof. Frank Merat
Fall 2003 Semester

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Textbook:
Electromagnetic Waves
Umran S. Inan and Aziz S. Inan
Prentice Hall
ISBN 0-201-36179-5

Web page: http://vorlon.cwru.edu/~flm/eecs412fr03/home.html

TENTATIVE SYLLABUS

TOPIC	READING *	COMMENTS
Review of Fields I Topics (6 lectures)	Any fields textbook	
• Electric Flux and Gauss's Law, electric dipole		
• Poisson's & Laplace's Equations, capacitance		
• Electrostatic boundary conditions		
• Ampere's law, magnetic dipole		
• Inductance		Take home exam
Planes waves in unbounded media (9 lectures)		
• Intro to plane Introduction, Maxwell's Equations	1-14	
• Plane Waves in Lossless Media	15-35	
• Plane Waves in Conducting Media	38-45	
• Conductors/Dielectrics and Skin Effect	45-59	HW#1
• Flow of Electromagnetic Power	59-75	
• Wave Polarization	78-95	
• Arbitrary Uniform Plane Waves	96-104	HW#2
Reflection, Transmission & Refraction at Planar Interfaces (6 lectures)		
• Reflection at Normal Incidence	120-131	
• Normal Incidence on a Dielectric	132-140	
• Multiple Dielectric Interfaces	140-155	HW#3
• Oblique Incidence on a Conductor	155-167	
• Reflection/Refraction at Oblique Incidence	167-188	
• Total Internal Reflection	189-201	HW#4
• Reflection/Refraction from Lossy Media	201-215	

MID-TERM EXAM

Parallel Plate and Dielectric Slab Waveguides (5 lectures)

• Parallel Plate Waveguide	249-286	HW#5
• Dielectric Waveguides	286-307	HW#6
• Wave Velocities	307-319	

Waves and transmission lines (6 lectures)	Supplemental notes	
• Transmission line behavior & circuit models		
• SWR, impedance, multi-port networks		HW#7
• Smith charts & impedance matching		HW#8

Cylindrical Waveguides & Cavity Resonators (6 lectures)		
• Rectangular Waveguides	331-353	
• Circular Waveguides	353-378	HW#9
• Cavity Resonators	378-400	

Antennas (5 lectures)	Supplemental notes.	
• Elementary Antennas	476-494	
• Monopoles and Dipoles		HW#10

FINAL EXAM (December 13th, 8:00-11:00 a.m.)

GRADING:

Take home review exam	10%
Mid-term exam	25%
Final exam	25%
Homework	30%
Term paper and presentation	10%

Term Paper and Presentation: Electricity and Magnetism consists of a basic theory (Maxwell's Equations) and a large number of applications. We will consider many of the applications during the course but we cannot cover all topics. You will select a topic beyond the course to explore independently. Below is a suggestive, but not complete set of topics.

- Wave Guides and Cavity Resonators
- Transmission lines
- Green's Functions
- Numerical FielSolutions (2D and 3D)
- Frequency dependence of the dielectric constant (Kramers-Kronig relations).
- Propagation of light in anisotropic crystals
- Wave propagation in nonlinear media

By the end of week 7, you need to submit a proposal and a bibliography for your paper. The proposal will consist of one or two paragraphs that outline your plan of study for the last two weeks of the semester. The content of the proposal should be comparable to a one-week section of the course. Presentations will be a twenty minutes in length during the last week of the term. I will try to schedule some time so that all presentations can be done in the last two days of the semester.