UNIVERSITY OF TORONTO
Department of Electrical and Computer Engineering
ECE320H1F – Fields and Waves
Course Outline 2005

	LEC 01	**LEC 02**
Name	Mr. M. Stickel	Professor M. Mojahedi (coordinator)
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Lecture Times	Mondays 1-2pm BA1210 Wednesdays 9-10am WB130 Thursdays 10-11am RS208	Mondays 10-11am BA1210 Tuesdays 1-2pm GB220 Fridays 1-2pm GB221

TUTORIAL SCHEDULE

TUT01:	Thursdays	1 pm-3 pm	SF3201	(Alternates starting Sept. 22nd)
TUT02:	Thursdays	4 pm-6 pm	GB405	(Alternates starting Sept. 22nd)

LABORATORY SCHEDULE

PRA01:	Thursdays	3 pm-6 pm	GB450	(Alternates starting Oct. 20th)
PRA02:	Fridays	3 pm-6 pm	GB450	(Alternates starting Oct. 14th)
PRA03:	Fridays	9 am-12 pm	GB450	(Alternates starting Oct. 21st)
PRA04:	Tuesdays	4 pm-7 pm	GB450	(Alternates starting Oct. 18th)
PRA05:	Tuesdays	9 am-12 pm	GB450	(Alternates starting Oct. 18th)
PRA06:	Fridays	9 am-12 pm	GB450	(Alternates starting Oct. 14th)

TEXTBOOK

Required

David K. Cheng, *Field and Wave Electromagnetics*, 2nd Ed., Addison-Wesley, 1992

Recommended

1) R. Feynman, R. Leighton, and M. Sands, *The Feynman Lectures on Physics Vol. 2*, Addison-Wesley, 1970
2) M. N.O. Sadiku, *Elements of Electromagnetics*, Oxford, 2001

COURSE GRADING

First Exam (Thursday, October 20th, 7pm – 8:15pm)	20 %
WB130: Last names A through K	
WB219: Last names L through Q	
WB342: Last names R through Z	
Second Exam (Wednesday, November 16th, 7pm – 8:15pm)	20 %
WW111 (Woodsworth Room 111): All students	
Laboratory Work	20 %
Final Exam	40 %

COURSE WEBSITE

http://ccnet.utoronto.ca/20059/ece320h1f/

ECE320H1F – Fields and Waves
Course Timetable 2005

Week	Lectures	Tutorials	Labs
Sept. 8 – 9	L1: Course introduction	–	–
Sept. 12 – 16	L2: TL circuit model L3: Wave chars. on infinite lines L4: TL wave equations solutions	–	–
Sept. 19 – 23	L5: Forward and backward waves L6: TL examples L7: Wave char. on finite lines	<u>Tutorial #1</u> Phasors	–
Sept. 26 – 30	L8: Matched TL L9: TLs as circuit elements L10: Lines with resistive terms.	–	–
Oct. 3 – 7	L11: Max/Min voltage along TLs L12: TL circuits L13: Transients on TLs	<u>Tutorial #2</u> Lines with arbitrary Z_L	–
Oct. 11 – 14	*Oct. 10: Thanksgiving (no lecture)* L14: Reflection diagrams L15: Smith chart derivation	–	<u>Lab #1 (02, 06)</u> Waves on Transmission Lines
Oct. 17 – 21	L16: Smith chart applications L17: Electromagnetic fields L18: Div theorem, curl, etc.	<u>Tutorial #3</u> Impedance Matching	<u>Lab #1 (01,03,04,05)</u> Waves on Transmission Lines
Oct. 24 – 28	L19: Maxwell's equations L20: Potential functions L21: Solutions of wave equations	–	<u>Lab #2 (02,06)</u> Design of a Double-Stub Matching Network
Oct. 31 – Nov. 4	L22: Source-free wave equations L23: EM boundary conditions L24: Plane waves in lossless media	<u>Tutorial #4</u> Vector Calculus Review	<u>Lab #2 (01,03,04,05)</u> Design of a Double-Stub Matching Network
Nov. 7 – 11	L25: TEM waves L26: Polarization of plane waves L27: Plane waves in lossy media	–	<u>Lab #3 (02, 06)</u> Resonant Cavity
Nov. 14 – 18	L28: Group velocity L29: Dispersion L30: Flow of EM power	<u>Tutorial #5</u> Waveguides	<u>Lab #3 (01,03,04,05)</u> Resonant Cavity
Nov. 21 – 25	L31: Normal inc. at conductor L32: Normal inc. at dielectric L33: Normal inc. at mult. diels.	–	<u>Lab #4 (02, 06)</u> Coaxial Photonic Crystal
Nov. 28 – Dec. 2	L34: Oblique inc. at dielectric L35: Snell's law, total ref., etc. L36: Radiation fields of el. dipoles	<u>Tutorial #6</u> Homework and Review	<u>Lab #4 (01,03,04,05)</u> Coaxial Photonic Crystal

ECE320H1F – Fields and Waves
Detailed Lecture Schedule 2005
(subject to change)

Lecture Number	Lecture Content	Textbook Sections
1	Course introduction, overview, and motivation	9-1
2	Introduction to transmission lines Distributed transmission-line circuit model General transmission-line equations in time	9-3 introduction
3	Wave characteristics on an infinite transmission line Time-harmonic transmission-line equations Propagation constant	7-7.1 9-3.1
4	Transmission line wave equation solutions Characteristic impedance	9-3.1
5	Forward and backward traveling waves Phase velocity	
6	Transmission line examples (lossless, low-loss, distortionless) Attenuation constant from power relations	9-3.1 9-3.3
7	Wave characteristics on finite transmission lines Input impedance	9-4 introduction
8	Matched transmission line Transmission line as circuit elements (introduction)	9-4.1
9	Transmission line as circuit elements (open, short, quarter-wavelength, half-wavelength)	9-4.1
10	Lines with resistive termination (reflection coefficient, standing wave ratio)	9-4.2
11	Maximum and minimum voltage locations along a line	9-4.2
12	Transmission-line circuits (reflection coefficient at the source, multiple reflections)	9-4.4
13	Transients on transmission lines	9-5 intro.
14	Reflection diagrams Pulse excitation	9-5.1 9-5.2
15	Smith chart for lossless lines (introduction and derivation)	9-6 introduction
16	Smith chart applications (plotting Γ, Z_{in}, Y_{in}, standing wave ratio)	9-6 introduction

Lecture Number	Lecture Content	Textbook Sections
17	Electromagnetic fields (vector and scalar fields) Coordinate systems, gradient, divergence	2-4, 2-5, 2-6, 2-7
18	Divergence theorem, curl, Stokes's theorem Helmholtz's theorem	2-8, 2-9, 2-10, 2-11, 2-12
19	Maxwell's equations for time-varying fields (differential and integral forms)	7-3
20	Potential functions (nonhomogeneous wave equations for $\boldsymbol{A}$ and V)	7-4
21	Solutions of wave equations for potentials	7-6.1
22	Source-free wave equations Time-harmonic fields and wave equations	7-6.2 7-7.2
23	Electromagnetic boundary conditions	7-5
24	Plane waves in lossless media	8-1, 8-2 intro.
25	Transverse electromagnetic (TEM) wave Polarization of plane waves (introduction)	8-2.2 8-2.3
26	Polarization of plane waves (linear, circular, elliptical)	8-2.3
27	Plane waves in lossy media (propagation constant, low-loss dielectrics)	8-3 intro. 8-3.1
28	Plane waves in lossy media (good conductors) Group velocity	8-3.2 8-4
29	Dispersion	8-4
30	Flow of electromagnetic power and the Poynting vector Instantaneous and average power densities	8-5
31	Normal incidence at a plane conducting boundary	8-6
32	Normal incidence at a plane dielectric boundary	8-8
33	Normal incidence at multiple dielectric interfaces Wave impedance of the total field Impedance transformation with multiple dielectrics	8-9
34	Oblique incidence at a plane dielectric boundary Example of perpendicular (E) polarization	8-10.2
35	Oblique incidence at a plane dielectric boundary Snell's law, total reflection, Brewster's angle	8-10 int. 8-10.1
36	Radiation fields of elemental dipoles	11-2.1