EE3FK4

Electromagnetics II

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ece3FK4/ECE3Fk4_Main_2008.htm

Info About Myself

B.Sc. in Electronics and Communication Engineering, Cairo University, Cairo, Egypt with Distinction (honors), 1992

M.Sc. in Engineering Mathematics (Optimization), Cairo University, 1996

Ph.D. in Computer Aided Design (CAD) of Microwave Circuits, McMaster University, 2000

P.Eng., Ontario, 2003

Author/CoAuthor of over 95 Journal and Conference papers

Info About Myself (Cont'd)

Research Areas: Optimization methods, computer-aided design and modeling of microwave circuits, neural networks applications, computational electromagnetics, and Photonics

Awards/Scholarships:
TRIO Student Internship in OSA, inc. 1997
Ontario Graduate Scholarship (OGS) 1998-2000,
NSERC PostDoctoral Fellowship 2000-2001,
Premier's Research Excellence Award (PREA) 2003, and
McMaster Tenure 2007

Supervisor/Co-supervisor to a number of graduate students

Teaching Experience

Teaching Assistant in Engineering Mathematics (Cairo University), 1992-1996

Teaching Assistant in Electrical Engineering (McMaster University) 1996-1999

Assistant Professor in the Department of Electrical and Computer Engineering, McMaster University since 2002:

- EE 750 Advanced Engineering Electromagnetics
- ECE 2EI4 Electronic Devices and Circuits
- ECE 3TP4 Signals and Systems
- ECE 758 Numerical Techniques in Electromagnetics
- ECE 2EI5 Electronic Devices and Circuits
- ECE 3FI4 Theory and Applications in Electromagnetics

Teaching Experience (Cont'd)

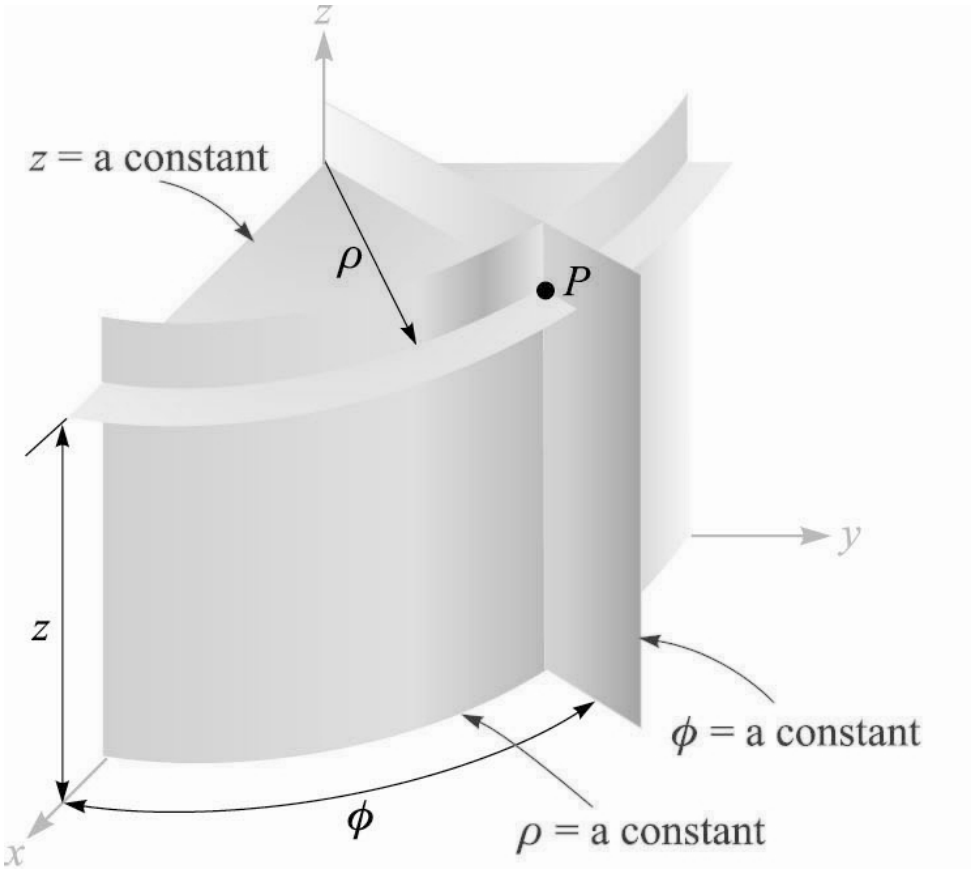
ECE 2FH3 Electromagnetics I
ECE 2CI5 Introduction To Electrical Engineering
ECE 3FK4 Electromagnetics II

Developer of a number of coursewares for several courses

Course Overview

1-Vector Calculus (Review yourself)

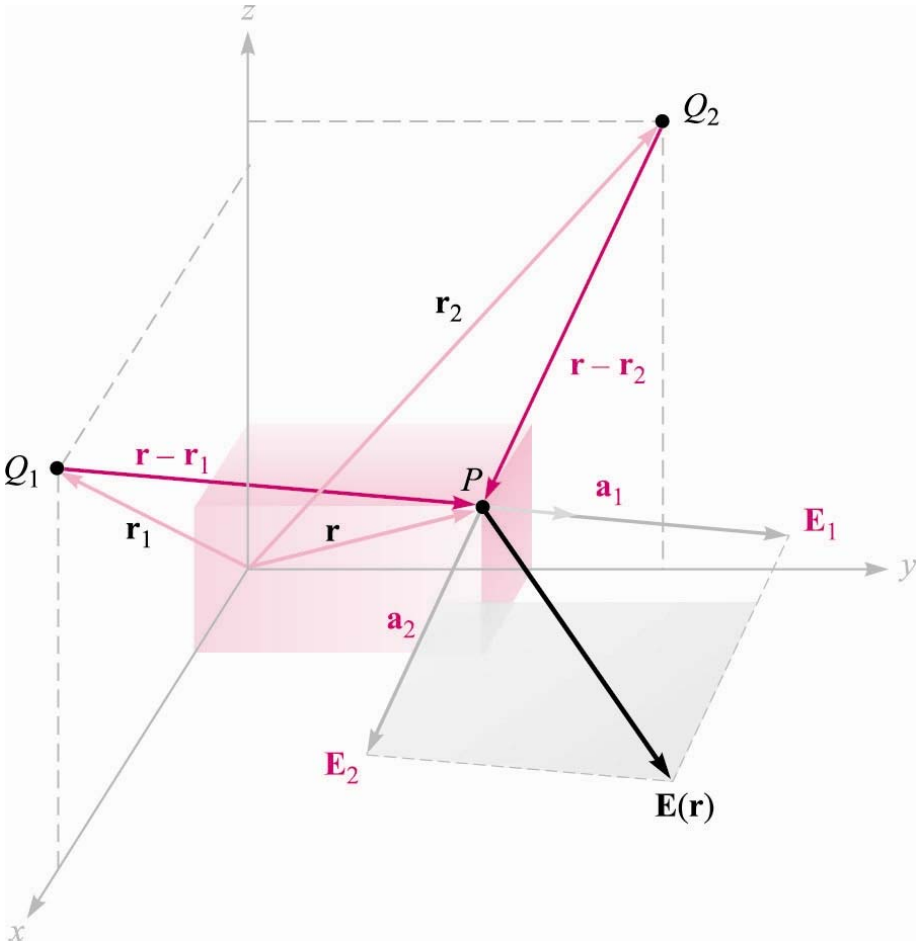
Line, surface and volume integrals. Gradient, Divergence and Curl of vector and scalar functions.



Course Overview (Cont'd)

2-Electrostatics (Reviewed)

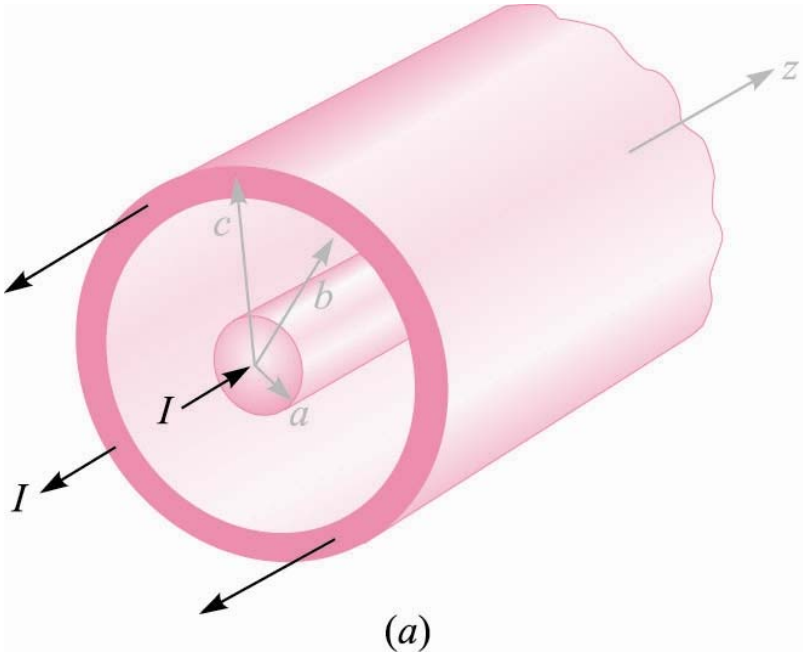
Calculating fields from point sources, line, surface and volume charges. Electric potential, dielectrics and capacitances



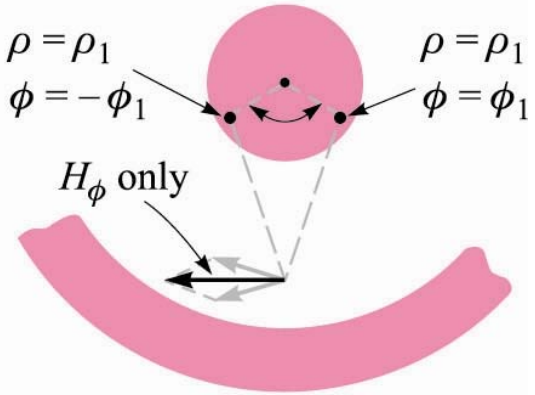
Course Overview (Cont'd)

3-MagnetoStatics (Reviewed)

Magnetic field generated by steady currents, magnetic materials, inductances



(a)



(b)

Course Overview (Cont'd)

4-Maxwell's Equations

$$\oiint_S \boldsymbol{D}.\boldsymbol{dS} = \iiint_V q_{ev}\, dV = Q_{ev}$$

$$\oiint_S \boldsymbol{B}.\boldsymbol{dS} = \iiint_V q_{mv}\, dV = Q_{mv}$$

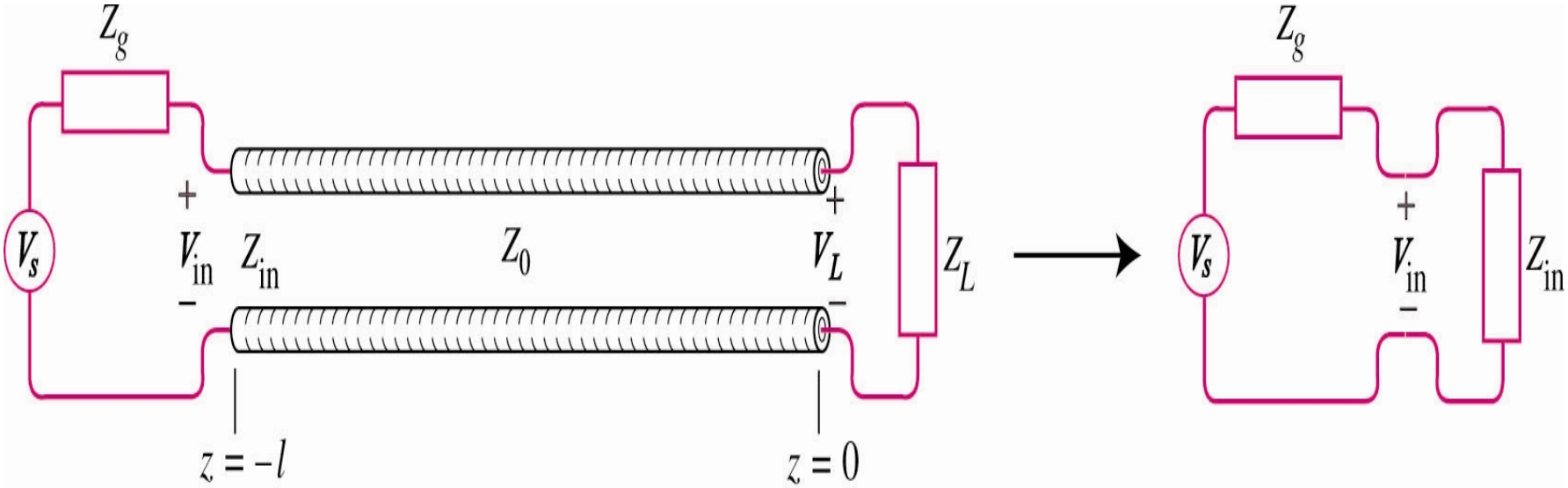
$$\oint_C \boldsymbol{H}.\boldsymbol{dl} = \iint_S \boldsymbol{J}.\boldsymbol{dS} + \frac{\partial}{\partial t}\iint_S \boldsymbol{D}.\boldsymbol{dS}$$

$$\oint_C \boldsymbol{E}.\boldsymbol{dl} = -\iint_S \boldsymbol{\mu}.\boldsymbol{dS} - \frac{\partial}{\partial t}\iint_S \boldsymbol{B}.\boldsymbol{dS}$$

Course Overview (Cont'd)

5-Transmission Lines and their applications

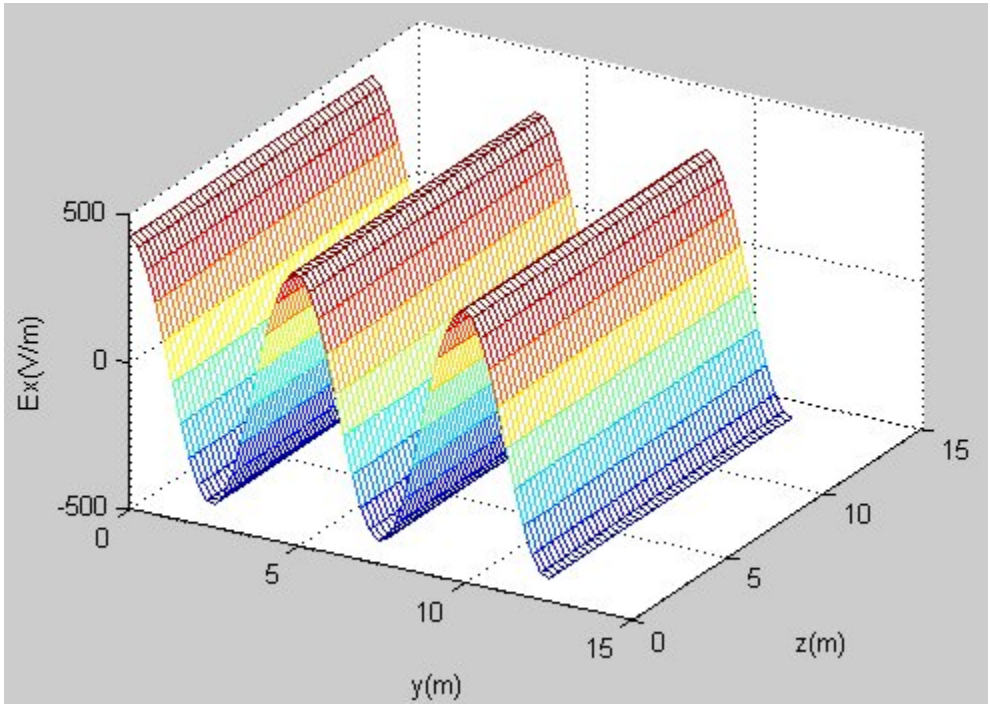
Telegrapher's equations, sinusoidal signals, time transients, standing wave ratio, examples



Course Overview (Cont'd)

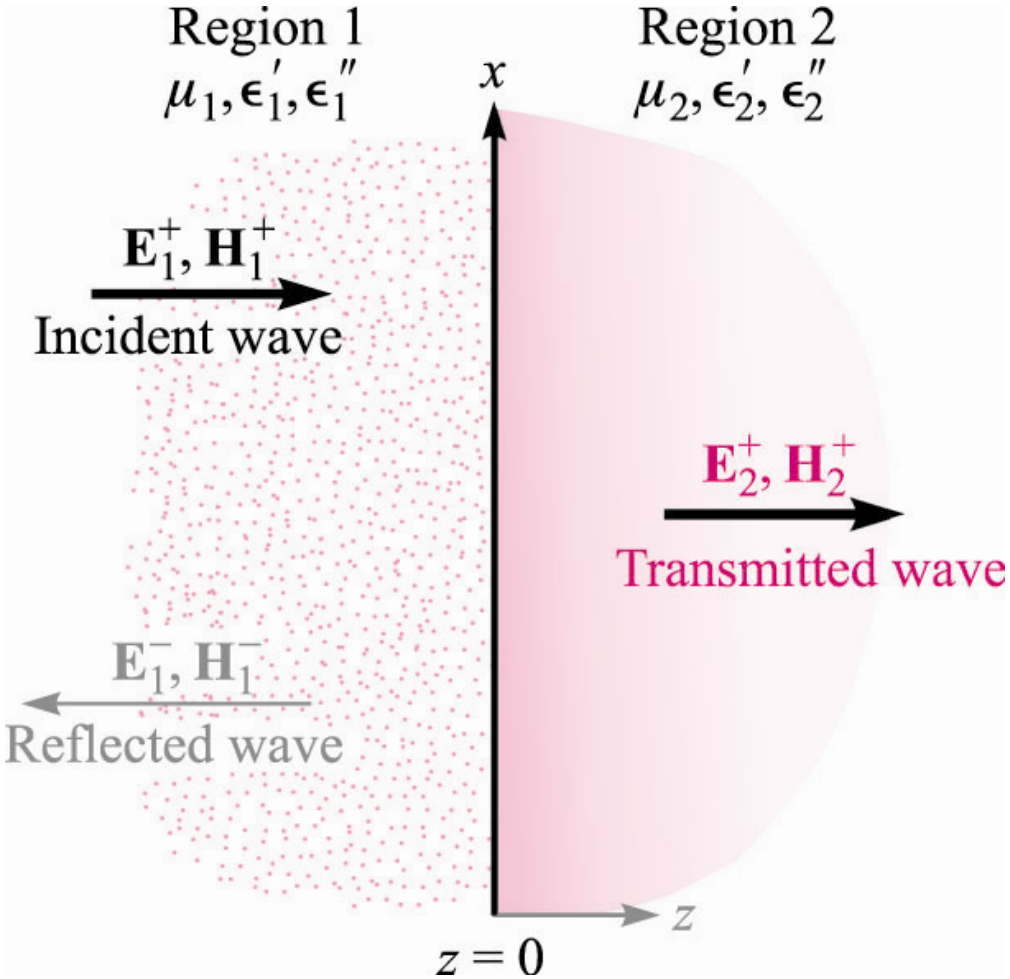
6. Plane Waves

Propagation of plane waves in different media



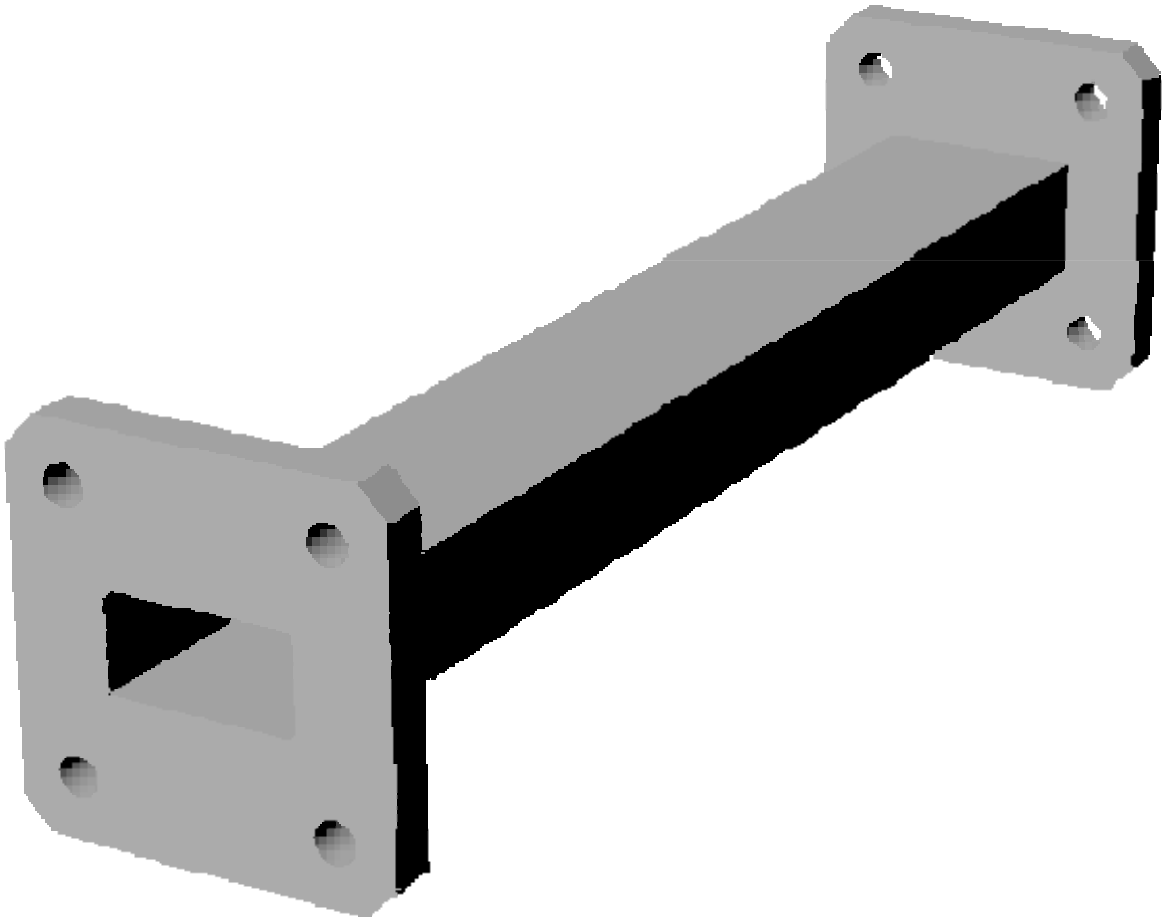
Course Overview (Cont'd)

7. Transmission and Reflection of Electromagnetic Waves



Course Overview (Cont'd)

8. Waveguides



Course Overview (Cont'd)

9. Antennas

Course Overview (Cont'd)

Text: Elements of Electromagnetics, Mathew N.O. Sadiku, 4th ed., Oxford University Press, 2006.

Courseware:
M.H. Bakr, *EE3FK4 Matlab Experiments Manual*, January 2008, McMaster University

CLASSES: Tuesday, 9:30 am - 10:20 am, ITB AB102
Wednesday, 9:30 am - 10:20 am, ITB AB102,
Friday, 9:30 am - 10:20 am, ITB AB102

Course Overview (Cont'd)

TUTORIALS: Tuesdays 1:30 pm -2:20 pm, HH/302

Tutorials start on Tuesday January 15th.

Office Hrs: 1 hour after classes.
Labs: Labs start on week of January 28th:

Lab 1: Magnetostatics I (Hardware) (Monday Jan. 28th -Friday Feb. 8th)
Lab 2: Magnetostatics II (Hardware) (Monday Feb. 11th- Friday Feb. 29th)
Lab 3: Transmission Lines I (Software) (Monday March 3rd- Friday March 14th)
Lab 4: Transmission Lines II (Software) (Monday March 17th - Friday March 28th)

Quizzes/Grading

1	Midterms	15%
3	In-class quizzes	15%
4	Labs	10%
	Matlab Assignments	10%
	Final Examination	50%

Midterm take place either on the last Tuesday of February or the First Tuesday of March.

We will have one quiz every 3 weeks in tutorials.

Quizzes/Grading (Cont'd)

Matlab Assignments are due in one week from the day the assignment is given

If you fail the final examination, you fail the course!

Homework problems are not marked. They help in strengthening your understanding of the subject. Solutions will be put in Thode (2 copies)

Final examination will be based on lecture examples, tutorials, homework problems, and Matlab assignments.

What is New?

Very friendly and easy-to-read textbook

Solutions of all problems in Thode

Good number of examples in lectures and tutorials

Matlab assignments to strengthen your understanding of the subject

Matlab Manual with 26 Matlab experiments

Copy only examples. Lectures are posted the night before.

I will conduct all tutorials

General Notes

Always be in class before the start time!

Use your McMaster email address. Expect a response within 72 hours.

Contest any exam/quiz grade within 30 days of the announcement of the result (including the final exam). I apologize for not responding to any late emails.

All examinations are regular booklet exams

Your attendance of the lectures and tutorials may save you in this course. Do not study on your own at home!.

General Notes (Cont'd)

Try all solved examples and drill problems

Review Vector Calculus and Matlab (Try the online tutorial)

My Exams are usually not trivial

We will use the formula sheet available on my webpage

You are only allowed to use McMaster approved calculator fx991!

Lab section changes start end of next week (I will email you)

General Notes (Cont'd)

Result of last Year (3FI4):

Number of Students: 90

A: 24 students (with 8 A+) B: 28 students

C: 20 students D: 16 students

F: 2 students

Very Important

I reserve the right to choose the format of any deferred midterm or differed final (i.e. format may be written or ORAL)

All announcements are made in class. The students are responsible for completing the graded material regardless of whether they received the announcement or not.

Survival Tips in EE3FK4

Attend all lectures and tutorials. I discuss the ideas of all exam problems in lectures and tutorials

Read the corresponding book sections on the same day of the lecture.

Solve all the drills and the homework problems

Do not look up solutions until you have spent enough time thinking!

Do all the Matlab assignments yourself. Do not depend on someone who will not be there during the exams.

Detailed Course Outline

Date	Description
Jan. 8	**Introduction to EE3FK4**
Jan 9	**Review of Electrostatics**: Coulomb's law, electric potential, Principle of Superposition, Applications to electric field and potential
Jan 11	**Review of Electrostatics**: Electric Flux, Gauss's law, Dielectric Properties of Matter, Dielectric Constant
Jan 15	**Review of Electrostatics**: Boundary Conditions, Method of Images, Capacitance
Jan 16	**Static Electric Fields:** Poisson and Laplace equations and their applications in the solutions of static electric fields
Jan 18	**Static Magnetic Fields:** Biot-Savart Law, Ampere's law of force, Applications
Jan 22	**Static Magnetic Fields:** Ampere's Law, Gauss's law of electromagnetism, magnetic vector potential
Jan 23	**Static Magnetic Fields**: Flux linkage, inductance, Examples
Jan 25	**Static Magnetic Fields:** Magnetic energy, boundary conditions
Jan 29	**Maxwell's Equations :** Faraday's Law
Jan 30	**Maxwell's Equations:** Ampere's law and Displacement Current

Feb 1	**Maxwell's Equations:** General Boundary Conditions, EM power flow
Feb 5	**Maxwell's Equations:** Time Harmonic Fields and Examples
Feb 6	**Plane Waves:** wave equation, wave impedance, examples
Feb 8	**TEM Waves:** definition of a TEM wave, wave impedance, propagation constant
Feb 12	**TEM Waves:** Reflection and Transmission of TEM Waves
Feb 13	**TEM Waves**: Reflection and Transmission at Interfaces
Feb 15	**TEM Waves**: Reflection and Transmission at Interfaces
Feb 19	**Midterm Recess**
Feb 20	**Midterm Recess**
Feb 22	**Midterm Recess**
Feb 26	**TEM Transmission Lines:** TL parameters, Characteristic impedance, input impedance
Feb 27	**TEM Transmission Lines:** Steady state analysis
Feb 29	**TEM Transmission Lines:** Examples of Transmission Lines
March 4	**Waveguides:** governing differential equations, Modes
March 5	**Waveguides:** Cut off frequency, propagation parameters
March 7	**WaveGuides**: Rectangular waveguides
March 11	**Waveguides:** Cylindrical waveguides
March 12	**Waveguides**: Examples

March 14	**Antennas**: Introduction
March 18	**Antennas:** Radiation pattern, gain, directivity
March 19	**Antennas:** The dipole antenna and its radiation pattern
March 21	**No Class: Good Friday**
March 25	**Antennas:** Different types of antennas
March 26	**Antennas:** Examples
March 28	**Review**
April 1	**Review**
April 2	**Review**
April 4	**Review**
April 8	**Review**
April 9	**Review**