Memorial University of Newfoundland
Faculty of Engineering and Applied Science

Engineering 7814 (Electromagnetics for Communications)
Course Particulars
Term 7, Spring 2005
Class of 2006

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COURSE RATIONALE

This course, offered to computer engineering students, is intended to give a background in the fundamental concepts and applications of electrostatics, magnetostatics and electromagnetic fields. It is designed to provide much of the mathematical and physical foundation necessary for the derivation of the governing equations of various communication channels components (eg., transmission lines, waveguides and antennas). Complete treatments of the latter topics are the subjects of more advanced courses.

TEXT: Fawaz T. Ulaby, Fundamentals of Applied Electromagnetics, 2004 Media Edition, Prentice-Hall, 2004 (an older edition should be fine).

COURSE OUTLINE

The text portions referenced in this course outline are, in some cases, not exhaustive of the material covered and, in other cases, contain more information than is required for the course. Because we are attempting to get to the physical processes described by the mathematics as quickly as possible, Unit 1 of this outline contains material from many parts of the first half of the textbook as indicated. Consequently, we will have to revisit a few sections at different points of the course. Units 2 and 3 are more sequentially tied to the textbook. In Unit 4, we take a brief look at some applications.

Unit 1 Vector Calculus and Applications

1–1 Review – A Few Comments on the Properties of Vectors (Chp.1, Section 3-1,4-3 and back flyleaf)
1–2 Coordinate Systems (Sections 3-2–3-3)
1–3 Line Integrals with Applications (Sections 4-5, 5-2, 5-4.2)
1–4 Surface and Volume Integrals with Applications (4-2,4-4, 5-4)
1–5 Vector Differential Operators (Summarized on back cover)and Vector Theorems
- – gradient (Sections 3-4, 4-5)
- – divergence (Sections 3-5, 4-4, 4-5, 5-4.1, 6-9,)
- – curl (Sections 3-6, 4-5, 5-4.2)

Also, read Sections 4-6–4-9

Unit 2 Maxwell's Equations – Time Varying Form
(Chapters 6–7)

2–1 Faraday's Law (Sections 6-1–6-2)
2–2 Ampere's law Revisited (Section 6-7)
2–3 Maxwell's Equations for Time-Harmonic Fields (Section 7-1)
2–4 Poynting's Theorem – Conservation of Power (Section 7-6)
2–5 Plane Waves in Free Space (Sections 7-1–7-2)
2–6 Polarization (Section 7-3)
2–7 Plane Waves in Lossy (Dissipative) Media (Section 7-4–7-5)

Unit 3 Reflection and Transmission of Plane Waves
(Chapter 8 and sections as listed)

3–1 Electric and Magnetic Field Boundary Conditions (Sections 4-9, 5-7, 6-8)
3–2 Reflection and Transmission of Plane Waves (Sections 8-1–8-2, 8-4, 8-5)
3–3 Standing Waves (Sections 2-5.2, 8-1.2)

Unit 4 Applications in Communications

4–1 Transverse Electromagnetic Transmission Lines (Selections from Chap. 2)
4–2 Fibre Optics (Section 8-3)

Evaluation Scheme

Evaluation Instrument	Value	Date
Assignments (5 or 6)	10%	Biweekly
Term Tests (2)	40%	June 10 July 15
Final Exam	50%	Wk. of Aug. 1-6