



Engineering 6813 — Electromagnetic Fields Fall, 2009

Instructor: Eric Gill, Ph.D., P.Eng.
Phone: 737-8922
WEB: <http://www.engr.mun.ca/~egill/>

Office Number: EN3046
Email: ewgill@mun.ca

COURSE RATIONALE

This is the second of two elementary courses, the first being Engineering 5812, designed to prepare students for further applications in engineering electromagnetics. Briefly reviewing the concepts associated with steady electric and magnetic fields, the material proceeds logically to the problem of time-varying electromagnetic fields. The ideas encountered will be essential to the understanding of applications in, for example, antenna theory and design and will provide the physical foundation for the discussion and derivation of the governing equations for various communication channels (eg. transmission lines, optic fibres, waveguides, etc.).

TEXT: *Engineering Electromagnetics*, 7th Ed., by W.H. Hayt, Jr. and J.A. Buck, McGraw Hill

Course Prerequisite: Engineering 5812—Basic Electromagnetics

Course Format: Lecture: 3hrs/wk ; Tutorial: 1hr/wk

COURSE OUTLINE

Unit 1 Relevant Electrostatics and Magnetostatics (Old and New)

- 1-1 Electrostatics: Basic Theorems, Laws, and Concepts (Chapters 1—5, 7)
- 1-2 Magnetostatics: Basic Theorems, Laws, and Concepts (Chapters 8 & 9)
 - Biot-Savart Law (Section 8.1)
 - Ampère’s Law (Sections 8.2, 8.3, 8.4)
 - Magnetic “Constitutive” Relationship (Section 8.5)
 - Scalar and Vector Potentials (Sections 8.6, 8.7)
 - Lorentz Force Equation and Related Concepts (Sections 9.1,9.2,9.3)
 - Force and Torque (Section 9.4)
 - Magnetic Materials and Boundary Conditions (Sections 9.5, 9.6, 9.7)

Unit 2 Time-Varying Fields and Maxwell’s Equations

- 2-1 Faraday’s Law (Section 10.1)
- 2-2 Ampère’s Law Revisited – Maxwell’s Fix! (Section 10.2)

- 2–3 Maxwell’s Equations Summarized
 - 2.3.1 Point Form (Section 10.3)
 - 2.3.2 Integral Form (Section 10.4)

Unit 3 The Uniform Plane Wave and Related Topics

- 3–1 The Helmholtz Equation and its Solution (Free Space) (Section 12.1)
- 3–2 Time Harmonic Analysis of Maxwell’s Equations (Sections 11.5 and 12.1)
- 3–3 Power Flow—the Poynting Vector (Section 12.3)
- 3–4 Plane Waves in Lossy Media (Section 12.2)
- 3–5 Propagation in Slightly Conducting and Good Conductors—Skin Depth (Section 12.4)
- 3–6 Polarization, Reflection and Transmission of Plane Waves (Sections 12.5 and selections from Chapter 13)

Unit 4 Applications

- 4–1 Transverse Electromagnetic (TEM) Transmission Lines
 - 4.1.1 The Telegrapher’s Equations and Related Concepts (Sections 11.1 – 11.8)
 - 4.1.2 Reflection and Transmission (Sections 11.9 –11.12)
- 4–2 Special Cases of the Lossless Line
 - 4.2.1 The Short-Circuit Line
 - 4.2.2 The Open-Circuit Line
- 4–3 Graphical Methods for Transmission Lines – The Smith Chart (Section 11.13)
- 4–4 Other Applications (Time Permitting)

Evaluation Scheme

Evaluation Instrument	Value	Approximate Date
6 Assignments	10%	Approximately Biweekly
Term Test 1	20%	Friday, October 16
Term Test 2	20%	Friday, November 20
Final Exam	50%	December

PLEASE NOTE: The tutorials are an essential part of this course as they will be used primarily for problem solving.

OFFICIAL OFFICE HOURS — Mondays and Wednesdays 4 PM – 5 PM. Students may check for help at any other time(s) and will be accommodated immediately or by subsequent appointment.

CALCULATOR POLICY – No graphing calculators or other text-memory devices will be allowed during testing sessions.