Faculty of Engineering, Architecture and Science

Department of Electrical and Computer Engineering

ELE531: Electromagnetics

Calendar Description:

Course hours: 4 Lecture hours/week and 2 Lab hours every other week.


Lab Manual: Microwave Fundamentals, Lab-Volt (Quebec) Ltd., 2001 Printing or beyond. (Every student has to have a new unused lab manual.)

References:

Course Management/Evaluation:
- Midterm Test 30%
- Lab Work 13%
- Final Examination 50%
- Lab Exam 7%

Note: Course written materials will be assessed not only on their technical or academic merit, but also on the communication skills of the author as exhibited through these written materials.

Detailed Course Outline:

1.0 Time-Varying Fields and Maxwell’s Equations 10

1.1 Electromagnetostatic Fields
- Coulomb’s law and Gauss’s Law (Review)
- Electric potential (Review)
- Poisson’s and Laplace’s Equations (Review)
- Biot-Savart’s Law and Ampere’s Circuital Law (Review)
- Vector Magnetic Potential and Vector Poisson’s Equation
- Time-invariant Maxwell's Equations (Review)
### 1. Faraday’s Law (Review)

### 2. Displacement Current

### 3. Maxwell's Equations in Point Form

### 4. Maxwell's Equations in Integral Form

### 5. Maxwell's Equations in the Frequency Domain

### 6. Boundary Conditions

### 7. Retarded Potentials

### 8. Uniform Plane Wave

#### 2.1 Wave Equation

#### 2.2 Plane Waves in Free Space

#### 2.3 Plane Waves in Perfect Dielectrics

#### 2.4 Plane Waves in Lossy Dielectrics

#### 2.5 Poynting Vector

#### 2.6 Plane Waves in Good Conductors (Skin Effect)

#### 2.7 Reflections of Plane Waves at Interfaces

#### 2.8 Standing Wave Ratio (SWR) and Input Impedance

### 9. Transmission Lines

#### 3.1 Transmission-Line Equations

#### 3.2 Input Impedance, SWR and Power

#### 3.3 Smith Chart

#### 3.4 Transmission-Line Applications

### 10. Waveguides

#### 4.1 Rectangular Waveguides

#### 4.2 Transverse Magnetic (TM) Modes

#### 4.3 Transverse Electric (TE) Modes

#### 4.4 Wave Propagation in the Guide

### 11. Antennas and Radiation

#### 5.1 Radiation from Infinitesimal Current Element

#### 5.2 Half-Wave Dipole Antenna

#### 5.3 Quarter-Wave Monopole Antenna

### Basic Microwave Measurements (ENG311)

- Familiarization with Microwave Equipment and Power Measurement (1,2)
- Calibration of Variable Attenuators and Attenuation Measurement (4,6)
- Standing Waves and Directional Coupler (7,8)
- Reflection Coefficient and SWR Measurement (9,10)
- Impedance Measurement (11)

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