THE CITADEL
THE MILITARY COLLEGE OF SOUTH CAROLINA

Department of Electrical and Computer Engineering

ELEC 318 Electromagnetic Fields **HW #9, due April 16th, 2015**

Reading Assignment: Chapter 7 (Sections 7.1, 7.2, 7.4, 7.6)

Written Assignment:

1. In a certain material, the conductivity is zero, the relative permeability is 2, and the relative permittivity is 10.
   The displacement current density is $60\sin\left(10^9 t - \beta z\right)\hat{\mathbf{x}}$ mA/m^2.
   Write a complete expression for the electric flux density.
   (Substitute the proper value for β in your expression.)

2. In free space, without any charge or current nearby, the magnetic field intensity is $\frac{1}{r}\cos\left(\omega t - 3z\right)\hat{\boldsymbol{\phi}}$ A/m. Determine the electric field intensity.
   (Substitute the proper value for ω in your expression.)

3. The electric field intensity of a propagating electromagnetic wave is $25\sin\left(2\pi\cdot 10^6 t - 6x\right)\hat{\mathbf{z}}$ V/m. Compute (a) the period of the wave, (b) the wavelength, and (c) the wave's velocity (as a vector).

4. A wave at a frequency of 50 MHz is propagating in a lossy dielectric material with a relative permittivity of 3.6, a relative permeability of 2.1, and a conductivity of 0.08 S/m. The electric field intensity phasor is $6e^{-\gamma x}\,\hat{\mathbf{z}}$ V/m.
   (a) Compute the intrinsic/wave impedance.
   (b) Write the complete magnetic field intensity phasor.
   (Substitute the proper value for γ in your expression.)