國立彰化師範大學103學年度碩士班招生考試試題

系所： 電信工程學研究所　　選考丁　　科目： 電磁學

☆☆請在答案紙上作答☆☆　　共 2 頁，第 1 頁

Weighting: problem 1-9 each counts 7%

1. The phasor form of the plane wave, $\overline{E}(y,t)=\mathbf{a}_x E_o\cos(\omega t-\beta y)+\mathbf{a}_z E_o\cos(\omega t-\beta y+\pi/2)$, is

   (A) $\mathbf{a}_x E_o e^{-j\beta y}+\mathbf{a}_z E_o e^{-j\beta y}$　(B) $\mathbf{a}_x E_o e^{-j\beta y}-\mathbf{a}_z jE_o e^{-j\beta y}$

   (C) $\mathbf{a}_x E_o e^{-j\beta y}+\mathbf{a}_z jE_o e^{-j\beta y}$　(D) $\mathbf{a}_x jE_o e^{-j\beta y}+\mathbf{a}_z E_o e^{-j\beta y}$

2. An E-field $\overline{E}(z)=\mathbf{a}_x 10\cos(9\pi\times10^8 t-3\pi z)$ (V/m) existed in the air. What is the coexisted magnetic field $\overline{H}$ at z = 0 plane?

   (A) $\mathbf{a}_y \frac{1}{12\pi}\cos(9\pi\times10^8 t)$　(B) $\mathbf{a}_y 5\times10^{-8}\cos(9\pi\times10^8 t)$

   (C) $\mathbf{a}_x \frac{1}{12\pi}\cos(9\pi\times10^8 t)$　(D) $\mathbf{a}_x 5\times10^{-8}\cos(9\pi\times10^8 t)$

3. Which one in the following is a uniform plane wave

   (A) $\mathbf{a}_x 10\cos(2\pi x)\cos(6\pi\times10^8 t-\beta z)$　(B) $\mathbf{a}_y 10\cos(2\pi x)\cos(6\pi\times10^8 t-\beta z)$

   (C) $\mathbf{a}_x 10\cos(2\pi x)\sin(3\pi y)\cos(6\pi\times10^8 t-\beta z)$　(D) $\mathbf{a}_x 10\cos(6\pi\times10^8 t-\beta z)$

4. An E-field plane wave has the form $\mathbf{a}_E 10\cos(6\pi\times10^8 t-3x-4y-5z)$, $\mathbf{a}_E$ is the polarization direction of the E-field. What is the wave number of the E-field?

   (A) 3×10^8　(B) $6\pi\times10^8$　(C) 5　(D) $5\sqrt{2}$

5. An E-field has the instantaneous form $\overline{E}(y,t)=\mathbf{a}_x E_o\cos(\omega t-\beta y)+\mathbf{a}_z E_o\cos(\omega t-\beta y+\pi/2)$ impinges normally on a perfectly conducting wall at y = 0. What is the induced current density $\overline{J}_s$ on the conducting surface at t = 0?

   (A) $\mathbf{a}_x \frac{E_o}{120\pi}$　(B) $\mathbf{a}_z \frac{E_o}{120\pi}$　(C) $\mathbf{a}_x \frac{E_o}{60\pi}+\mathbf{a}_z \frac{E_o}{60\pi}$　(D) $\mathbf{a}_x \frac{E_o}{60\pi}$

6. For a uniform plane wave propagating in the free space, the electric field of the wave is given by $\overline{E}=(\mathbf{a}_x-2\mathbf{a}_y+\mathbf{a}_z)E_o\cos(\omega t-x-y-z)$ (V/m). What is the polarization of the plane wave?

   (A) LP　(B) RHCP　(C) LHCP　(D) EP

7. An *x*-polarized uniform plane E-field with frequency of 1 GHz has a maximum amplitude of 10 V/m propagates along the +z direction in air. The wave travels into a lossless medium located at the region $z \geq 0$ with the dielectric permittivity and permeability of $\varepsilon = 2.25\varepsilon_o$, $\mu = \mu_o$, respectively. What is the reflection coefficient at the interface $z = 0$?

   (A) -0.1　　(B) 0.1　　(C) 0.2　　(D) -0.2

8. A lossless transmission line of characteristic impedance $Z_0 = 50\ \Omega$ is terminated by a load impedance $Z_L = 25 + j25\ \Omega$. Please find the reflection coefficient at the load.

   (A) $0.31\angle -82.12^\circ$　(B) $0.31\angle 82.12^\circ$　(C) $0.447\angle 116.57^\circ$　(D) $0.447\angle 63.43^\circ$

9. A 200 (MHz) generator with $V_g = 10\angle 0^o$ (V) and an internal resistance $Z_g = 50\ \Omega$ is connected to a lossless 50-Ω air line (ε_o, μ_o) that is 0.45 (m) long and terminated in a $50 + j50\,\Omega$ load. From the result, find is the value below that is close to the standing wave ratio S ($S = \dfrac{1+|\Gamma_L|}{1-|\Gamma_L|}$),

   (A) 2.62　　(B) 3　　(C) 3.25　　(D) 3.78

Weighting: problem 10 counts 15 % and problem 11 counts 22%

10. Given a static electric field intensity $\overline{D} = \hat{a}_x kx^2 + \hat{a}_y ky + \hat{a}_y kz^2 + 9$ (V/m) in free space, find the charge density distribution ρ_v at the point （3, 4, 0）(m). (please show all your work)

11. Solve the Laplace equation for the cylindrical coordinate system as following structure. Calculate the potential everywhere and the surface charge density on the V_0 metal plate.
    Note here the initial conditions are $V(\phi = 0) = 0$, $V(\phi = \phi_0) = V_0$, and $V(\phi = \pi) = 0$