國立彰化師範大學104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☆☆　　

Weighting: problems 1-9 each counts 7%

1. The phasor form of the plane wave, $\overline{E}(y,t) = \mathbf{a}_x E_o \cos(\omega t - \beta y) + \mathbf{a}_y E_o \cos(\omega t - \beta y + \pi/2)$, is _____.
   (A) $\mathbf{a}_x E_o e^{-j\beta y} + \mathbf{a}_z E_o e^{-j\beta y}$　　(B) $\mathbf{a}_x E_o e^{-j\beta y} - \mathbf{a}_z j E_o e^{-j\beta y}$
   (C) $\mathbf{a}_x E_o e^{-j\beta y} + \mathbf{a}_y j E_o e^{-j\beta y}$　　(D) $\mathbf{a}_x j E_o e^{-j\beta y} + \mathbf{a}_z E_o e^{-j\beta y}$

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

3. 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 phase velocity?
   (A) 2×10^8 m/s　　(B) $2\pi\times10^8$ m/s　　(C) 3×10^8 m/s　　(D) $3\pi\times10^8$ m/s

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 polarization of the reflected wave?
   (A)LP　　(B)RHCP　　(C)LHCP　　(D)EP

6. An *x*-polarized uniform plane E-field 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

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 maximum amplitude at the region $z \geq 0$?
   (A) 10V/m　　(B) 8V/m　　(C) 12V/m　　(D) 6V/m

8. A lossless transmission line is terminated by a load of reflection coefficient $\Gamma_L = 0.7e^{j45^o}$. Find the reflection coefficient Γ at a distance ℓ = 0.125 λ from the load.

   (A) $\Gamma = 0.7e^{j90^o}$　(B) $\Gamma = 0.7e^{j15^o}$　(C) $\Gamma = 0.7e^{-j15^o}$　(D) $\Gamma = 0.7e^{-j45^o}$

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 25+*j*25 Ω load. From the result, find which is the value below that is close to the standing wave ratio S ($S = \frac{1+|\Gamma_L|}{1-|\Gamma_L|}$).

   (A) 2.62　(B) 3　(C) 3.25　(D) 3.78

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

10. Please solve the *Laplace* equation $\frac{1}{R^2}\frac{\partial}{\partial R}\left(R^2\frac{\partial V}{\partial R}\right) = 0$ for V with providing the initial conditions $V(a) = V_0$ and $V(b) = 0$.

11. Given a static electric field intensity $\overline{D} = \hat{a}_x(kx^2 + ky) + \hat{a}_y(ky + kx) + \hat{a}_z(kz^2 + 2kz + 9)$ (V/m) in free space, find the charge density distribution ρ_v at the point(1, 1, 1)(m). (please show all your work)