

國立彰化師範大學105學年度碩士班招生考試試題

系所： 機電工程學系(選考己)、
電機工程學系(選考丙)、
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3頁，第1頁

一、選擇題：(每題6分，共計60分)

1. If $f(x, y, z) = x^3y^2z$, find the value of $\nabla f(1, 1, 2) \cdot (\mathbf{a}_x1 + \mathbf{a}_y1 + \mathbf{a}_z2)$ in Cartesian coordinates.
(A) 12 (B) 10 (C) 0 (D) -6
2. If $f(x, y, z) = x^3y^2z$ find $\nabla^2 f$ at the point $P(1, 1, 2)$ in the Cartesian coordinate system
(A) 10 (B) 12 (C) 14 (D) 16
3. Given a static electric field intensity $\bar{D} = \hat{a}_x kx + \hat{a}_y 3ky + \hat{a}_z kz^2$ (V/m) in free space, which point below has a zero charge density distribution ρ_v .
(A) (0, 0, 0) (B) (1, 2, -2) (C) (1, 0, 0) (D) (0, 0, 1)
4. Plane $z = 10$ m is uniformly distributed with charge with the charge density of 2 nC/m^2 . The electric field intensity at the origin is (hint : $\epsilon_0 = \frac{10^{-9}}{36\pi}$)
(A) $-\mathbf{a}_z 10\pi \text{ V/m}$ (B) $-\mathbf{a}_z 72\pi \text{ V/m}$ (C) $-\mathbf{a}_z 18\pi \text{ V/m}$ (D) $-\mathbf{a}_z 36\pi \text{ V/m}$
5. An E-field $\bar{E}(z) = \mathbf{a}_x 10 \cos(8\pi \times 10^8 t - 2\pi z)$ (V/m) exists in the dielectric media. What is the phase velocity?
(A) $2 \times 10^8 \text{ m/s}$ (B) $2\pi \times 10^8 \text{ m/s}$ (C) $4 \times 10^8 \text{ m/s}$ (D) $4\pi \times 10^8 \text{ m/s}$
6. An E-field has the instantaneous form $\bar{E}(y, t) = \mathbf{a}_x E_o \cos(\omega t - \beta y) + \mathbf{a}_z E_o \sin(\omega t - \beta y)$ 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) RHEP
(E) LHEP
7. A generator with $V_g = 10 \angle 0^\circ$ (V) and an internal resistance $Z_g = 50 \Omega$ is connected to a lossless $50\text{-}\Omega$ transmission line of 0.125λ and terminates to a load of $50 + j50 \Omega$. From the results below, which one is closed to the absolute voltage value $|V_{in}|$ at the transmission line's input terminal
(A) 5.62 (B) 6.95 (C) 8.25 (D) 3.78

國立彰化師範大學105學年度碩士班招生考試試題

系所： 機電工程學系(選考己)、
電機工程學系(選考丙)、
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3頁，第2頁

8. A lossless transmission line is terminated by a load of reflection coefficient $\Gamma_L = 0.7e^{j60^\circ}$. Find the reflection coefficient Γ at a distance $\ell = 0.25\lambda$ from the load.
(A) $\Gamma = 0.7e^{j90^\circ}$ (B) $\Gamma = 0.7e^{j15^\circ}$ (C) $\Gamma = 0.7e^{-j30^\circ}$ (D) $\Gamma = 0.7e^{-j45^\circ}$
9. A 0.125λ lossless transmission line having characteristic impedance of 50Ω is terminated by a load of reflection coefficient $\Gamma_L = 0.73e^{-j30^\circ}$. Find the closest input impedance at the input terminal from below.
(A) $10 - j28\Omega$ (B) $15 - j10\Omega$ (C) $15 - j28\Omega$ (D) $10 + j20\Omega$
10. The phasor form of the plane wave, $\vec{E}(y, t) = \mathbf{a}_x E_o \sin(\omega t - \beta y) + \mathbf{a}_y E_o \cos(\omega t - \beta y + \pi/2)$, 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) $-\mathbf{a}_x j E_o e^{-j\beta y} + \mathbf{a}_y j E_o e^{-j\beta y}$ (D) $\mathbf{a}_x j E_o e^{-j\beta y} + \mathbf{a}_z E_o e^{-j\beta y}$

二、演算題：(每題 20 分，共計 40 分)

1. A point charge Q is placed at a height $z = h$ above an infinite grounded plate (in x - y plane).
Find
(a) the electromagnetic force between the point charge and the grounded plane.
(b) the energy required for moving the point charge to $z = \infty$.
2. (a) Find the magnetic flux density \vec{B} at the center of a square loop carrying a current I . The side length of the square loop is a .
(b) A circular loop that has a radius b and carries a current I produces the same magnetic flux density at the center of the circular loop. Find the ratio of b to a .

國立彰化師範大學105學年度碩士班招生考試試題

The Complete Smith Chart Black Magic Design

科目：電磁學

共3頁，第3頁

