※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

以下均為單選題

1. (4%) Find the total charge contained in a cylindrical volume defined by $r \le 2$ m and $0 \le z \le 3$ m if $\rho_v = 20rz$ (mC/m^3).

(A) 0.5 C
(B) 1 C
(C) 1.5 C
(D) 2 C

2. (4%) If $\overline{J} = \hat{y}4xz(A/m^2)$, find the current I flowing through a square with corners at (0, 0, 0), (2, 0, 0), (2, 0, 2), and (0, 0, 2)

(A) 10 A
(B) 12 A
(C) 14 A
(D) 16 A

3. (4%) Given the electric flux density $\overline{D} = \hat{x}2(x+y) + \hat{y}(3x-2y)$ (C/m^2), determine the total charge Q enclosed in a cube 2 m on a side.

(A) 0 C
(B) 1 C
(C) 2 C
(D) 3 C

4. (4%) Current I flows along the positive z-direction in the inner conductor of a long coaxial cable and returns through the outer conductor. The inner conductor has radius a, and the inner and outer radii of the outer conductor are b and c, respectively. Determine the magnetic field in $r \ge c$ region.

(A) $\frac{rI}{2\pi a^2}$
(B) $\frac{I}{2\pi r}$
(C) 0
(D) $\frac{\sqrt{b^2+c^2}}{2\pi r^2}$

5. (4%) Given that a current sheet with surface current density $\overline{J_s} = \hat{x}8$ (A/m) exists at $y = 0$, the interface between two magnetic media, and $\overline{H_1} = \hat{z}11$ (A/m) in medium 1 ($y > 0$), determine $\overline{H_2}$ in medium 2 ($y < 0$).

(A) $\hat{z}1$
(B) $\hat{z}3$
(C) $\hat{x}1$
(D) $\hat{x}3$

見背面

6. (4%) A wire carrying a current of 4 A is formed into a circular loop. If the magnetic field at the center of the loop is 20 A/m, what is the radius of the loop if the loop has 10 turns.
   (A) 1m
   (B) 2 m
   (C) 3 m
   (D) 4 m

7. (4%) For a uniform plane wave of frequency 10^6 Hz propagating in a nonmagnetic material medium, the propagation constant is known to be (0.05+j0.1) (1/m). Find the distance in which the fields are attenuated by e^{-1}.
   (A) 5 m
   (B) 10 m
   (C) 15 m
   (D) 20 m

8. (4%) The region $z<0$ and $z>0$ are nonmagnetic perfect dielectrics of permittivities , ε_1 and ε_2 , respectively. For a uniform plane wave incident from the region $z<0$ normally onto the boundary $z=0$, find $\frac{\varepsilon_1}{\varepsilon_2}$ for the electric field of the reflected wave is -1/3 times the electric field of the incident wave.
   (A) 2
   (B) 4
   (C) 6
   (D) 8

9. (4%) In a region of static electric field $\overline{E} = yz\hat{x} + zx\hat{y} + xy\hat{z}$, find the potential difference V_A-V_B for A(2,2,2) and B(1,1,1).
   (A) 0 V
   (B) 5 V
   (C) -7 V
   (D) -1 V

10. (4%) The magnetic field in a given dielectric medium is given by $\overline{H} = \hat{y}6\cos(2z)\sin(2\times10^7 t - 0.1x)\ \ (\mathrm{A/m})$, where x and z are in meters. Determine the phase velocity of the electromagnetic wave.
   (A) 2×10^8 (m/s)
   (B) 3×10^8 (m/s)
   (C) 5×10^8 (m/s)
   (D) 1.5×10^8 (m/s)

接次頁

11. (5%) The magnetic field associated with a uniform plane wave propagating in the +z-direction in free space is given by $\overline{H} = H_0 \cos(6\pi \times 10^7 t - 0.2\pi z)\hat{y}$ (A/m). Find the instantaneous power flow across a surface of area 1m^2 in the z=0 plane at t=(1/8) μs.
(A) 0 W
(B) 1 W
(C) 1.5 W
(D) 3 W

12. (5%) The electric field of a plane wave is given by $\overline{\mathrm{E}}(\mathrm{z},\mathrm{t}) = \hat{x}\,3\cos(\omega \mathrm{t} - \mathrm{kz}) + \hat{y}\,4\cos(\omega \mathrm{t} - \mathrm{kz})\ (\mathrm{V/m})$. Determine the polarization state of the corresponding electromagnetic wave.
(A) Linear Polarization
(B) Right-Hand Circular Polarization
(C) Left-Hand Circular Polarization
(D) Elliptical Polarization

13. (4%) The general expression of the voltage on a lossless transmission line in the sinusoidal steady state is

$$V(z,t) = A\cos\left[\omega\left(t-\frac{z}{v_p}\right)+\theta\right]+B\cos\left[\omega\left(t+\frac{z}{v_p}\right)+\phi\right].$$

Which one of the following statements is wrong?
(A) The current can be expressed as

$$I(z,t) = \frac{1}{Z_0}\left\{A\cos\left[\omega\left(t-\frac{z}{v_p}\right)+\theta\right]+B\cos\left[\omega\left(t+\frac{z}{v_p}\right)+\phi\right]\right\}$$

, where Z_0 is the characteristic impedance of the transmission line.
(B) If B is zero, there is no standing wave on the transmission line.
(C) The first term and the second term represent the waves going in the +z and –z directions, respectively.
(D) ω/v_p is the propagation constant.

14. (4%) A 50-Ω transmission line is terminated by a load. Which one of the following statements is wrong?
(A) If the load impedance is 0 Ω and the electrical length of the transmission line is 90 degree, the input impedance is ∞.
(B) If the load impedance is 100 Ω and the electrical length of the transmission line is 90 degree, the input impedance is 20 Ω.
(C) If the load impedance is 200 Ω and the electrical length of the transmission line is 180 degree, the input impedance is 200 Ω.
(D) If the load impedance is 30 Ω and the electrical length of the transmission line is 360 degree, the input impedance is 30 Ω.

見背面

15. (4%) For the system impedance of Z_0, what is the component which can match the impedance at point A to point B along the constant VSWR circle as shown in Fig. 1?

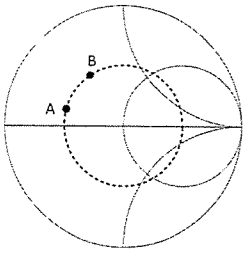


Fig. 1

(A) A series capacitor.
(B) A series resistor.
(C) A series transmission line with characteristic impedance of Z_0.
(D) A shunt short-circuited transmission line with characteristic impedance of Z_0.

16. (4%) Which one cannot allow TEM wave propagation?
(A) Rectangular metal waveguide.
(B) Coaxial cable.
(C) Parallel-plate waveguide.
(D) Stripline.

17. (4%) For a rectangular metallic waveguide with dimensions of a = 4 cm and b = 2 cm, which one of the following statements is wrong?
(A) The mode with the lowest cutoff frequency is the dominate mode.
(B) The dominant mode is TE_{10} mode.
(C) In the frequency range between the cutoff frequencies of TE_{10} and TE_{11} modes, only one mode is allowed to propagate in the waveguide.
(D) The rectangular metallic waveguide can be treated as a high-pass filter.

18. (4%) In the system shown in Fig. 2, which one of the following statements is wrong?

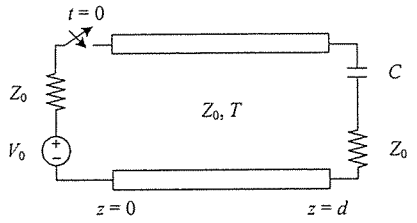
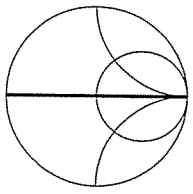


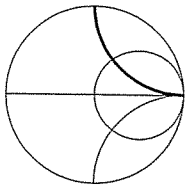
Fig. 2

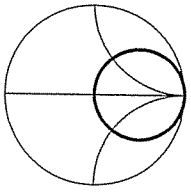
(A) $V(z,t) = V_0/2$ for $z = 0$ and $0 < t < T$.
(B) The voltage across the capacitor, C, is 0 when $t = T$.
(C) The reflection voltage at $z = d$ is 0 when $t = T$.
(D) $V(z,t)$ at $z = d$ will be $V_0/2$ as t tends to infinity.

接次頁

19. (4%) Which thick line on the Smith chart represents purely real reflection coefficients?

(A) 

(B) 

(C) 

(D) None of the above.

20. (4%) Fig. 3 shows the equivalent circuit for an infinitesimal section of transmission line. For a low-loss transmission line, we assume $\omega L >> R$ and $\omega C >> G$, which one of the following statements is wrong?

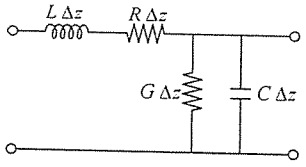


Fig. 3

(A) Characteristic impedance $\approx \sqrt{L/C}$.

(B) Propagation constant $\approx \omega\sqrt{LC}$.

(C) L accounts for the magnetic field due to current flow.

(D) R accounts for the dielectric loss.

21. (4%) A short-ended 50-Ω transmission line is operated at 2 GHz. The wavelength of the transmission line at 2 GHz is 10 cm. Which length can make the input impedance of the short-ended transmission line to be capacitive?

(A) 1.25 cm.

(B) 2.5 cm.

(C) 3.75 cm.

(D) None of the above.

見背面

22. (4%) A parallel plate waveguide is filled by the dielectric with $\varepsilon = 9\varepsilon_0$ and $\mu = \mu_0$. If the cutoff frequency of $TE_{1,0}$ mode for the waveguide is 10 GHz, find the spacing, d, between the two plate.
(A) 1 cm.
(B) 0.5 cm.
(C) 1/3 cm.
(D) None of the above.

23. (4%) Fig. 4 shows the reflection and transmission of an obliquely incident uniform plane wave on a plane boundary between two different perfect dielectric media. Which one of the following statements is wrong?

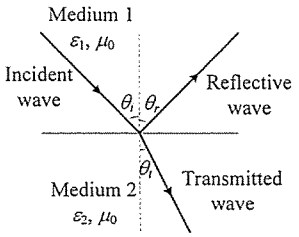


Fig. 4

(A) $\theta_r = \theta_i$.
(B) For the case of normal incident, the reflection coefficients of perpendicular polarization and parallel polarization are equal.
(C) If $\theta_i > \sin^{-1}\sqrt{\varepsilon_2 / \varepsilon_1}$, the time average power of the incident wave is entirely reflected.
(D) If an elliptically polarization wave incidents with $\theta_i = \tan^{-1}\sqrt{\varepsilon_1 / \varepsilon_2}$, the reflected wave will be linearly polarized perpendicular to the plane of incidence

24. (6%) Fig. 5(a) and (b) represent the standing wave patterns of a transmission line terminated by a short circuit and an unknown load (Z_L), respectively. If the d_{min} is $\lambda_g/4$ and the characteristic impedance of the transmission line and the source impedance are both 50 Ω, what is the impedance of Z_L? (λ_g: wavelength of the transmission line)

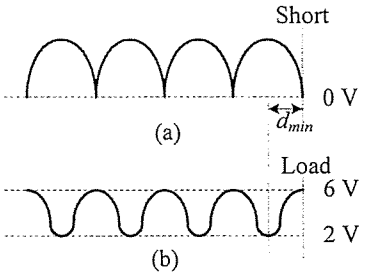


Fig. 5

(A) 30 – j 40 Ω.
(B) 16.67 Ω.
(C) 150 Ω.
(D) None of the above.

試題隨卷繳回