

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
December, 2024

Marks Scored:

Level : B.E.

Year : III

Exam Roll No. :

Time: 30 mins.

Registration No.:

Course : EEEG 309

Semester : II

F. M. : 10

Date **12 DEC 2024**

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices. Symbols have their usual meaning.

- If a plane electromagnetic wave satisfies the equation  $(\partial^2 E_x / \partial y^2) = C^2 (\partial^2 E_x / \partial t^2)$  where  $C^2 = \epsilon_0 \mu_0$ , the wave propagates in the \_\_\_\_\_
  - X-direction
  - Y-direction
  - Z direction
  - XY plane at angle of 45 degrees between X and Z direction
- For short-circuited transmission line, the reflection coefficient equals to \_\_\_\_\_
  - Zero
  - Infinite
  - 1
  - 1
- The electric field of a uniform plane wave in free space is travelling along the positive x direction and the electric field is given by  $E = 10 (a_y + j a_z) e^{-j25x}$ . The frequency and polarization respectively are \_\_\_\_\_
  - 4 GHz and right circular
  - 4 GHz and left circular
  - 1.2 GHz and right circular
  - 1.2 GHz and left circular
- Which of the following represents the Poisson's equation?
  - $\Delta^2 V = 0$
  - $\Delta^2 V = \rho_v / \epsilon_0$
  - $\Delta^2 V = -\rho_v / \epsilon_0$
  - $\Delta^2 V = -\epsilon_0 / \rho_v$
- EM wave expressed as  $\vec{E}(z,t) = 5 \sin(8 \times 10^9 t + 3z) \hat{a}_y$  v/m, the value of phase constant is \_\_\_\_\_
  - 8 rad/m
  - 4 rad/m
  - 5 rad/m
  - 3 rad/m
- The Ampere - Maxwell's equation is given by?
  - $\Delta \times \vec{H} = \vec{J} + \partial \vec{B} / \partial t$
  - $\Delta \times \vec{H} = \vec{J} + \partial \vec{D} / \partial t$
  - $\Delta \times \vec{E} = \vec{J} + \partial \vec{B} / \partial t$
  - $\Delta \times \vec{H} = \vec{J} - \partial \vec{B} / \partial t$
- Which of the following frequency falls in the millimeter wave?
  - 2.4 GHz
  - 6 GHz
  - 25 GHz
  - 46 GHz
- Which of the following is true for non-time varying field?
  - $\Delta \times \vec{E} = 0$
  - $\Delta \times \vec{E} = 1$
  - $\Delta \times \vec{E} = \partial \vec{B} / \partial t$
  - $\Delta \times \vec{E} = -\partial \vec{B} / \partial t$
- The phase constant for a wave propagating through a perfect dielectric medium is given by
  - $\omega \sqrt{\mu \epsilon}$
  - $\sqrt{j \omega \sqrt{\mu \epsilon}}$
  - $\sqrt{-j \omega \sqrt{\mu \epsilon}}$
  - $\sqrt{\omega \sqrt{\mu \epsilon}}$

10. For a good conductor, if 'f' is the operating frequency, which of the following is true for the skin depth ( $\delta$ )?
- a.  $\delta \propto \frac{1}{\sqrt{f}}$       b.  $\delta \propto \frac{1}{f^2}$       c.  $\delta \propto \frac{1}{\sqrt{f^3}}$       d.  $\delta \propto \frac{1}{f}$
11. Poynting theorem relates the electric field intensity,  $\vec{E}$  and a magnetic field intensity,  $\vec{H}$  to the rate of energy flow per unit area at a point P as \_\_\_\_\_
- a.  $\vec{P} = \vec{E}/\vec{H}$       b.  $\vec{P} = \vec{H}/\vec{E}$       c.  $\vec{P} = 1/(\vec{E}/\vec{H})$       d.  $\vec{P} = \vec{E} \times \vec{H}$
12. A transmission line having characteristic impedance ( $Z_0$ ) equal to  $75 \Omega$  is used to deliver power to  $300 \Omega$  load. The VSWR of the circuit is \_\_\_\_\_
- a. 1      b. 2      c. 3      d. 4
13. For a lossless transmission, the transmission line parameters are related as \_\_\_\_\_
- a.  $R=0, G \neq 0$       b.  $R/G = C/L$       c.  $R=0, G = 0$       d.  $R/G = L/C$
14. The modes supported by waveguide are \_\_\_\_\_
- a. TM and TEM      b. both TM and TE      c. TEM and TE      d. Only TEM
15. If a transmission line with inductive reactance of  $41.97 \Omega$  and capacitive reactance of  $1132.5 \Omega$  is operated at 1 GHz, then its phase constant is \_\_\_\_\_
- a. 0.1 rad/m      b. 0.3 rad/m      c. 0.03 rad/m      d. 30 rad/m
16. In a wave guide if TM mode exists for z-direction propagation then \_\_\_\_\_
- a.  $E_z=0, H_z \neq 0$       b.  $E_z \neq 0, H_z=0$       c.  $H_z=0, E_z=0$       d.  $E_z \neq 0, H_z \neq 0$
17. The characteristic impedance of the line having primary constants L and C as 35 milli henry and 70 micro farad respectively is \_\_\_\_\_
- a.  $16.45 \Omega$       b.  $13.82 \Omega$       c.  $32.67 \Omega$       d.  $22.36 \Omega$
18. For a given range of wavelength, which of the following system is best for a transmission line load matching?
- a. Single stub matching  
b. Double stub matching  
c. Single stub matching with adjustable position  
d. Quarter wave transformer
19. For TE mode of operation in rectangular waveguide, the modes of lowest order are \_\_\_\_\_
- a.  $TE_{11}$       b.  $TE_{01}$       c.  $TE_{10}$       d.  $TE_{00}$
20. If the direction of propagation is z, which of the following is true for magnetic field component in x direction for TE mode of operation in a rectangular waveguide?
- a.  $H_x = -\gamma \frac{\partial H_x}{\partial x} / h^2$       b.  $H_x = -\gamma \frac{\partial H_y}{\partial x} / h^2$       c.  $H_x = \gamma \frac{\partial H_z}{\partial x} / h^2$       d.  $H_x = -\gamma \frac{\partial H_z}{\partial x} / h^2$