

c. $l > \lambda/4$, and $Z_L = \infty$ d. none.

Ans: (b) $l < \lambda/4$, and $Z_L = \infty$

10. The group velocity (v_g) can be expressed as

- a. $v_g = \omega/\beta$ b. $v_g = d\omega/d\beta$
c. $v_g = -d(\angle S_{21})/d\omega$ d. $v_g = -d\omega/d\beta$

Ans: (b) $v_g = d\omega/d\beta$

11. Let c be the velocity of electromagnetic wave in free space. Then for fast wave

- a. $v_p > c$ b. $v_g > c$ a. $v_p v_g > c^2$ d. $v_p = v_g = c$.

Ans: a. $v_p > c$

12. What is the relationship between β and k_0 for a fast wave structure?

- a. $\beta = k_0$ b. $\beta > k_0$ c. $\beta < k_0$ d. $\beta = 2 \times k_0$

Ans: (c) $\beta < k_0$

13. If h is the height of the substrate and λ_0 is the free space wavelength, what precaution should be taken to minimize surface wave excitation?

- a. $h/\lambda_0 \gg 1$ b. $h/\lambda_0 \ll 1$ c. $h/\lambda_0 = 1$ d. $h/\lambda_0 = \lambda_0/4$

Ans: (b) $h/\lambda_0 \ll 1$

14. Consider a RG-401U semi rigid coaxial cable, with inner and outer conductor diameters of 0.0645 inch and 0.215 inch, and a Teflon dielectric with $\epsilon_r = 2.2$. What is the highest usable frequency before the TE_{11} waveguide mode starts to propagate?

- a. 18.8 GHz b. 16.8 GHz c. 19.8 GHz d. none

Ans: (b) 16.8 GHz.

15. When frequency increases, skin depth of a conductor

- a. increases, b. decreases, c. remain same, d. not frequency dependent.

Ans: (b) decreases

16. The loss that increases at millimeter wave frequencies due to skin effect is

- a. conduction loss, b. dielectric loss, c. radiation loss, d. corona loss.

Ans: (a) conduction loss

17. The problem that appears due high standing waves on a transmission line connected to an antenna is that

- a) Power lost in the transmission line increases, b) high power source cannot be used,
c) antenna gain decreases, d) **power delivered to antenna decreases.**

Ans: d) power delivered to antenna decreases.

18. A transmission line has a capacitance of 15 pF / ft. and an inductance of 0.15 μ H/ft. Then the characteristic impedance of the line is

- a) 100 Ω , b) 75 Ω , c) 77.5 Ω , d) 50 Ω .

Ans: a) 100 Ω

19. If a transmission line is terminated with a resistance equal to its characteristic impedance then

a) the standing wave ratio will be minimum, b) the input impedance will be twice the terminating resistance, c) the reflection coefficient will be unity, d) the line loss will be maximum.

Ans: a) the standing wave ratio will be minimum

20. Conductor loss increases at millimeter wave frequencies because of

a) smaller skin depth, b) higher surface roughness, c) both a and b, d) none.

Ans: c) both a and b.