

Assignment III (Guiding Structure II)

- Tick the most appropriate answer.
 - All symbols have their usual meaning.
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1. Transverse resonance appears in a microstrip line when its width is approximately
a. $\lambda_g/4$, b. $\lambda_g/2$, c. λ_g , d. does not depend on λ_g

Ans: (b) $\lambda_g/2$

2. The optimal thickness of metal that might be used for any PCB is
a. $0.25 \times$ skin depth, b. $0.5 \times$ skin depth, c. $1 \times$ skin depth, d. $5 \times$ skin depth.

Ans: d. $5 \times$ skin depth

3. For any PCB based millimeter-wave circuits, power lost to surface wave modes
a. decreases with frequency, b. depends on type of guiding structures c. does not depend on frequency d. depends on loss tangent of the dielectric material.

Ans: b. depends on type of guiding structures

4. In microstrip coupled line, effective dielectric constant in i) even mode is $\epsilon_{re,even}$ and ii) in odd mode is $\epsilon_{re,odd}$, then which is the correct relationship?
a. $I = II$ b. $I > II$ c. $I < II$ d. cannot be determined

Ans: (b) $I > II$.

5. Threshold frequency of coupling to TM_0 surface wave mode is—

a. $\frac{c}{2\pi d} \sqrt{\frac{2}{\epsilon_r - 1}} \tan^{-1} \epsilon_r$, b. $\frac{c}{4d\sqrt{\epsilon_r - 1}}$ c. $\frac{c}{\sqrt{\epsilon_r}(2W + d)}$ d. $\frac{c}{4\pi d} \sqrt{\frac{2}{\epsilon_r - 1}} \tan^{-1} \epsilon_r$

Ans: (a) $\frac{c}{2\pi d} \sqrt{\frac{2}{\epsilon_r - 1}} \tan^{-1} \epsilon_r$

6. The mode that provides minimum conductor loss for NRD guide is
a. LSE_{11} , b. LSM_{11} , c. TE_{11} d. TM_{11} .

Ans: (a) LSM_{11} .

7. For NRD guide, which mode has the lowest cutoff frequency?
a. LSE_{11} b. LSM_{11} , c. LSE_{21} , d. LSM_{21}

Ans: (a) LSE_{11} .

8. Which mode in the NRD guide is/are non-radiative?
a. LSE_{11} , b. LSM_{11} , c. LSE_{21} d. All of these

Ans: (d) All of these.

9. Assuming the guiding structures are fabricated in the same PCB, tick the correct statement.
a. Substrate integrated waveguide may provide lower loss than a microstrip line.
b. The power handling capability of CPW line is more than that for a Substrate integrated waveguide
c. For a Substrate integrated waveguide, total loss increases with frequency.
d. None of the above.

Ans: a. Substrate integrated waveguide may provide lower loss than a microstrip line.

10. Which guide suffers more conductor loss at millimeter-wave frequencies?
a. image guide, b. insular image guide, c. Trapped image guide, d. NRD guide.

Ans: (a) image guide.

11. If ϵ_r increases for an image guide, electric field confinement in the dielectric region
a. increases, b. decreases, c. remains constant, d. does not depend on ϵ_r .

Ans: (a) increases.

12. If $2a$ is the width and b is the height of the dielectric channel of an image guide, then mono mode bandwidth is maximum when
a. $2a = b$, b. $a = b$, c. $a = 2b$, d. $\sqrt{a} = \sqrt{b}$.

Ans: b. $a = b$

13. If ϵ_r decreases for an image guide, cutoff frequency for E_{11}^y mode will—
a. increase, b. decrease, c. remain constant, d. does not depend on ϵ_r .

Ans: (b) decreases.

14. Arrange according to losses of the guides—i. Air filled rectangular waveguide, ii. microstrip line, iii. Substrate integrated waveguide (SIW),
a. i>ii>iii, b. ii>i>iii, c. ii>i>iii, d. ii>iii>i.

Ans: (d) ii>iii>i.

15. For a properly designed substrate integrated waveguide (SIW) at millimeter-wave frequencies, the loss component that is highest
a. radiation loss, b. leakage loss, c. dielectric loss, d. conductor loss.

Ans: (d) conductor loss.

16. At a given frequency, loss increases for a SIW when
a. via separation increases, b. thickness is reduced, c. ϵ_r of the dielectric channel decreases, d. first two.

Ans: d. first two.

17. The relationship between average power handling capability (P_{avg}) of SIW, its height (h) and ϵ_r of the dielectric channel is
a. $P_{avg} \propto h$, b. $P_{avg} \propto 1/h$, c. $P_{avg} \propto \epsilon_r$, d. none of these.

Ans: (a) $P_{avg} \propto h$.

18. The peak power handling capability (P_{peak}) of SIW with increasing frequency
a. increases, b. decreases, c. remains constant, d. first increases and then decreases.

Ans: (b) decreases.

19. Ionization breakdown occurs in the following guiding structures
a. microstrip line, b. image guide, c. SIW, d. air filled waveguide.

Ans: d. air filled waveguide.

20. Choose the correct statement.
a. In comparison to ionization breakdown, Multipaction is more localized effect.
b. Probability of ionization breakdown increases if vacuum is used in a guiding structure.
c. Multipaction is due to resonant growth of free electron between two surfaces.

d. Dielectric breakdown is due to resonant growth of free electron between two surfaces.

Ans: c. Multipaction is due to resonant growth of free electron between two surfaces.