

Assignment IV (Antennas)

- Tick the most appropriate answer.
 - All symbols have their usual meaning.
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1. Antennas convert _____ to _____
a. guided wave to space wave, b. electric field to magnetic field, c. TE to TM wave d. both (a) and (b).

Ans. a. guided wave to space wave

2. For practical antenna, gain is always _____ than directivity
a. greater b. lower, c. equal to d. greater or lower depending on physical parameters.

Ans. (b) lower.

3. Antenna gain mainly depends on
a) physical dimension of the antenna, b) type of materials used to realize the antenna, c) both (a) and (b), d) operating temperature.

Ans. c) both (a) and (b).

4. If the broad dimension of an antenna is D , the far field region of an antenna starts at a distance

a. greater than $0.62\sqrt{D^3/\lambda}$, b. greater than $\frac{D^2}{\lambda}$, c. greater than $\frac{2D^2}{\lambda}$, d. greater than $\frac{2D}{\lambda}$.

Ans. (c) greater than $\frac{2D^2}{\lambda}$

5. At millimeter wave frequencies, antenna efficiency of an antenna realized in PCB technology
a. increases with increasing dielectric constant, b. decreases with increasing dielectric constant c. increases with increasing thickness of PCB, d. none of the above.

Ans. b. decreases with increasing dielectric constant.

6. The mode that is an example of leaky mode is
a. TEM, b. LSE and LSM c. slow wave d. fast wave.

Ans. d. fast wave.

7. Based on geometry of an antenna, leaky wave antenna can be of type—
a. uniform, b. quasi-uniform, c. periodic, d. all of these.

Ans. (d) all of these.

8. Example of a balanced antenna is
a. leaky wave antenna, b. printed dipole, c. printed patch, d. all of these.

(b) printed dipole.

9. Surface wave in mm wave antenna provides—
a. lower side lobes and lower cross pol, b. lower side lobes and higher cross pol,
c. higher side lobes and lower cross pol d. higher side lobes and higher cross pol.

Ans. d. higher side lobes and higher cross pol.

10. A resonating slot etched in the broad wall of a rectangular waveguide radiates when it is
a. parallel to side walls and placed at the center,
b. perpendicular to side walls and placed at the center,
c. parallel to side walls and placed with an off set with the center,
d. perpendicular to side walls and placed with an off set with the center.

Ans. c. parallel to side walls and placed with an off set with the center.

11. The following frequency band is an example of unlicensed band at millimeter wave frequencies.
a. 26.5—40 GHz, b. 59-64 GHz, c. 76—77 GHz, d. 90-94 GHz.

Ans. b. 59-64 GHz.

12. The main beam angle θ with respect to the broadside direction of a uniform leaky wave antenna is given by—

a. $\cos^{-1}\left(\frac{k_0}{\beta}\right)$, b. $\cos^{-1}\left(\frac{\beta}{k_0}\right)$, c. $\sin^{-1}\left(\frac{k_0}{\beta}\right)$, d. $\sin^{-1}\left(\frac{\beta}{k_0}\right)$; where, k_0 , free space wave number, β phase constant.

Ans. (d) $\sin^{-1}\left(\frac{\beta}{k_0}\right)$

13. In case of a periodic leaky wave antenna, the main beam scanning with respect to the direction of wave propagation with increasing frequency starts from—
a. forward to backward, b. backward to forward, c. broad side to backward direction, d. depends on physical structure of the antenna.

Ans. (b) backward to forward.

14. An on chip antenna is designed for 77 GHz application. It will be called electrically small if it is smaller than
a. 3.89 mm, b. 1.94 mm, c. 1.24 mm d. 0.62 mm.

Ans. (c) 1.24 mm.

15. An on chip antenna printed on the following material provides better efficiency.
a. low resistivity silicon backed by an air cavity
b. high resistivity silicon backed by an air cavity

- c. thick layer of low resistivity silicon,
- d. low resistivity silicon backed by a metal ground plane.

Ans. b. high resistivity silicon backed by an air cavity.

16. Thickness of the substrate of a PCB based antenna to avoid surface wave loss should be smaller than

- (a) λ_0
- (b) $\lambda_0/2$
- (c) $\lambda_0/4$
- (d) $\lambda_0/100$

Ans. (d) $\lambda_0/100$

17. Beam direction and beam width of a leaky wave antenna is controlled by respectively—

- a. α and β ,
- b. β and α ,
- c. β only,
- d. α only.

Ans. b. β and α .

18. Dielectric loading shifts the main beam of a leaky wave antenna towards

- a. broad side, b. backward, c. forward end fire direction, d. sideways

Ans. c. forward end fire direction

19. Radiation from waveguide slot antenna can be controlled by

- a. slot offset, b. slot width, c. slot orientation d. all of them

Ans. d. all of them

20. For on chip antennas, semiconductor material is treated as the

- a. substrate b. ground plane c. an alternative to metal d. superstrate.

Ans. a. substrate.