

Two marks Question and answers

UNIT 1

1. Define an antenna.

Antenna is a transition device or a transducer between a guided wave and a free space wave or vice versa. Antenna is also said to be an impedance transforming device.

2. What is meant by radiation pattern?

Radiation pattern is the relative distribution of radiated power as a function of distance in space. It is a graph which shows the variation in actual field strength of the EM wave at all points which are at equal distance from the antenna. The energy radiated in a particular direction by an antenna is measured in terms of field strength. (E Volts/m)

3. Define Radiation intensity?

The power radiated from an antenna per unit solid angle is called the radiation intensity U (watts per steradian or per square degree). The radiation intensity is independent of distance.

4. Define Beam efficiency?

The total beam area (WA) consists of the main beam area (WM) plus the minor lobe area (Wm). Thus $WA = WM + Wm$. The ratio of the main beam area to the total beam area is called beam efficiency. Beam efficiency = $SM = WM / WA$.

5. Define Directivity?

The directivity of an antenna is equal to the ratio of the maximum power density to its average value over a sphere as observed in the far field of an antenna.

6. What are the different types of aperture?

i) Effective aperture. ii). Scattering aperture .iii) Loss aperture. iv) collecting aperture. v). Physical aperture.

7. Define Aperture efficiency?

The ratio of the effective aperture to the physical aperture is the aperture efficiency. i.e

Aperture efficiency = $\Omega_{ap} = Ae / Ap$ (dimensionless).

8. What is meant by effective height?

The effective height h of an antenna is the parameter related to the aperture. It may be defined as the ratio of the induced voltage to the incident field. i.e $H = V / E$.

9. What are the field zones?

The fields around an antenna may be divided into two principal regions.

- i. Near field zone (Fresnel zone)
- ii. Far field zone (Fraunhofer zone)

10. What is meant by Polarization?

The polarization of the radio wave can be defined by direction in which the electric vector E is aligned during the passage of at least one full cycle. Also polarization can also be defined the physical orientation of the radiated electromagnetic waves in space. The polarization are three types. They are Elliptical polarization , circular polarization and linear polarization.

11. What is meant by front to back ratio?

It is defined as the ratio of the power radiated in desired direction to the power radiated in the opposite direction. i.e $FBR = \text{Power radiated in desired direction} / \text{power radiated in the opposite direction}$.

12. Define antenna efficiency

The efficiency of an antenna is defined as the ratio of power radiated to the total input power supplied to the antenna.

Antenna efficiency = Power radiated / Total input power

13. What is radiation resistance ?

The antenna is a radiating device in which power is radiated into space in the form of electromagnetic wave.

14. What is meant by antenna beam width?

Antenna beam width is a measure of directivity of an antenna. Antenna beam width is an angular width in degrees, measured on the radiation pattern (major lobe) between points where the radiated power has fallen to half its maximum value. This is called as beam width between half power points or half power beam width.(HPBW).

15. What is meant by reciprocity Theorem.?

If an e.m.f is applied to the terminals of an antenna no.1 and the current measured at the terminals of the another antenna no.2, then an equal current both in amplitude and phase will be obtained at the terminal of the antenna no.1 if the same emf is applied to the terminals of antenna no.2.

16. What is meant by isotropic radiator?

An isotropic radiator is a fictitious radiator and is defined as a radiator which radiates fields uniformly in all directions. It is also called as isotropic source or omni directional radiator or simply unipole.

17. Define gain

The ratio of maximum radiation intensity in given direction to the maximum radiation intensity from a reference antenna produced in the same direction with same input power.

18. Define self impedance

Self impedance of an antenna is defined as its input impedance with all other antennas are completely removed i.e away from it.

19 . Define mutual impedance

The presence of near by antenna no.2 induces a current in the antenna no.1 indicates that presence of antenna no.2 changes the impedance of the antenna no.1.This effect is called mutual coupling and results in mutual impedance.

20. What is meant by Beam Area.?

The beam area or beam solid angle of an antenna is given by the normalized power pattern over a sphere.

UNIT 2- APERTURE AND SLOT ANTENNAS

1.What is a Short Dipole?

A short dipole is one in which the field is oscillating because of the oscillating voltage and current. It is called so, because the length of the dipole is short and the current is almost constant throughout the entire length of the dipole. It is also called as Hertzian Dipole, which is a hypothetical antenna and is defined as a short isolated conductor carrying uniform alternating current.

2.Why a short dipole is also called an elemental dipole?

A short dipole that does have a uniform current will be known as the elemental dipole. Such a dipole will generally be considerably shorter than the tenth wavelength maximum specified for a short dipole. Elemental dipole is also called as elementary dipole, elementary doublet and hertzian dipole.

3.What is a Infinitesimal Dipole?

When the length of the short dipole is vanishing small, then such a dipole is called a infinitesimal dipole. If dl be the infinitesimally small length and I be the current, then $I dl$ is called as the current element.

4.What do you understand by retarded current?

Since, the short electric dipole is so short, the current which is flowing through the dipole is assumed to be constant throughout its length. The effect of this current is not felt instantaneous at a distance point only after an interval equal to the time required for the wave to propagate over the distance r is called the retardation time.The retarded current $[I]=I_0 \exp(j \omega(t-r/c))$ Where $\omega r/c$ is the phase retardation.

5.Define induction field

The induction field will predominate at points close to the current element ,where the distance from the center of the dipole to the particular point is less. This field is more effective in the vicinity of the current element only. It represents the energy stored in the magnetic field surrounding the current element or conductor. This field is also known as near field.

6.Define Radiation field

The radiation field will be produced at a larger distance from the current element, where the distance from the center of the dipole to the particular point is very large. It is also called as distant field or far field.

7. At what distance from the dipole is the induction field equal to the radiation field?

As the distance from the current element or the short dipole increases, both induction and radiation fields emerge and start decreasing. However, a distance reaches from the conductor at which both the induction and radiation field becomes equal and the particular distance depends upon the wavelength.

8. What is a half wave dipole?

A half wave antenna is the fundamental radio antenna of metal rod or tubing or thin wire which has a physical length of half wavelength in free space at the frequency of operation

9. What is a loop antenna?

A loop antenna is a radiating coil of any convenient cross-section of one or more turns carrying radio frequency current. It may assume any shape (e.g. rectangular, square, triangular and hexagonal)

10. How to increase the radiation resistance of a loop antenna

The radiation resistance of a loop antenna can be increased by:

1. increasing the number of turns
2. inserting a ferrite core of very high permeability with loop antenna's circumference which will rise the magnetic field intensity called ferrite loop.

11. What are the types of loop antennas?

Loop antennas are classified into:

- A. Electrically small (circumference $< \lambda/10$)
- B. Electrically large (dimension comparable to λ)

12. What are Electrically Small loop antennas?

Electrically Small loop antennas is one in which the overall length of the loop is less than one-tenth of the wavelength. Electrically Small loop antennas have small radiation resistances that are usually smaller than their loop resistances. They are very poor radiators and seldom employed for transmission in radio communication.

13. What are Electrically large loop antennas?

Electrically Large loop antennas is one in which the overall length of the loop approaches the wavelength.

14. List out the uses of loop antenna

- 1) It is used as receiving antenna in portable radio and pagers
- 2) It is used as probes for field measurements and as directional antennas for radio wave navigation
- 3) It is used to estimate the direction of radio wave propagation

15. What is meant by uniform linear array.?

An array is linear when the elements of the array are spaced equally along the straight line. If the elements are fed with currents of equal magnitude and having a uniform progressive phase shift along the line, then it is called uniform linear array .

16.What is Broad side array?

Broad side array is defined as an arrangement in which the principal direction of radiation is perpendicular to the array axis and also the plane containing the array element. For Broad side array the phase difference adjacent element is $d = 0$.

17.Define End fire array

End fire array is defined as an arrangement in which the principal direction of radiation is coincides with the array axis.

18.Define Side Lobe Ratio

Side Lobe Ratio is defined as the ratio of power density in the principal or main lobe to the power density of the longest minor lobe.

19.What is the advantage of pattern multiplication? .

Useful tool in designing antenna .It approximates the pattern of a complicated array without making lengthy computations.

Unit 3 Antenna Arrays

1. State Huygen's Principle?

Huygen's principle states that each point on a primary wave front can be considered to be a new source of a secondary spherical wave that a secondary wave front can be constructed as the envelope of these secondary waves.

2. What is Slot Antenna?

The slot antenna is an opening cut in a sheet of a conductor, which is energized through a coaxial cable or wave guide.

3. Which antenna is complementary to the slot dipole?

The dipole antenna is the complementary to the slot antenna. The metal and air regions of the slot are interchanged for the dipole.

4. Define lens antenna?

An antenna, which collimates the incident divergent energy to prevent it from spreading in undesired directions, is called as lens antenna.

5. What are the different types of lens antenna?

- 1.E plane metal plate lens
- 2.H plane metal plate lens

6. What is a dielectric lens antenna?

Dielectric lens antennas are the antennas in which the traveling wave fronts are delayed by lens media

7. What are the drawbacks of lens antenna?

Lens antennas are used only at higher frequencies (above 3 GHz) because at lower frequencies they become bulky and heavy. Lens antennas have excessive thickness at low frequencies. Costlier for the same gain and beam width in comparison with reflectors

8. What are the advantages of stepped dielectric lens antenna?

- It is mechanically strong
- Reduces weight
- Less power dissipation

9. What are the advantages of lens antenna

The feed and feed support do not block the aperture as the rays are transmitted away from the feed. It has greater design tolerance. It can be used to feed the optical axis and hence useful in applications where beam is required to be moved angularly with respect to the axis.

10. What do you mean by sectoral horn and pyramidal horn?

If flaring (opened out) is done only in one direction, then it is called as a sectoral horn. If flaring is done along both the walls (E & H), then it is called as a pyramidal horn.

11. What are the various feeds used in reflectors?

1. Dipole antenna
2. Horn feed
3. End fire feed
4. Cassegrain feed

12. State uniqueness theorem

For a given set of sources and boundary conditions in a lossy medium the solution to Maxwell's equation is unique

13. What is meant by uniform linear array.?

An array is linear when the elements of the array are spaced equally along the straight line. If the elements are fed with currents of equal magnitude and having a uniform progressive phase shift along the line, then it is called uniform linear array.

14. What are the types of array.?

- a. Broad side array. b. End fire array c. Collinear array. d. Parasitic array.

15. What is Broad side array.?

Broad side array is defined as an arrangement in which the principal direction of radiation is perpendicular to the array axis and also the plane containing the array element

16. Define End fire array.?

End fire array is defined as an arrangement in which the principal direction of radiation coincides with the array axis.

17. What is collinear array.?

In this array the antenna elements are arranged coaxially by mounting the elements end to end in straight line or stacking them one over the other with radiation pattern circular symmetry. Eg. Omnidirectional antenna.

18. What is Parasitic array.?

In this array the elements are fed parasitically to reduce the problem of feed line. The power is given to one element from that other elements get by electro magnetic coupling. Eg. Yagi uda antenna.

19. Define beam width of major lobe?

It is defined the angle between the first nulls (or) it is defined as twice the angle between the first null and the major lobe maximum direction.

20. What is the need for the Binomial array.?

The need for a binomial array is i). In uniform linear array as the array length is increased to increase the directivity, the secondary lobes also occurs. ii) For certain applications, it is highly desirable that secondary lobes should be eliminated completely or reduced to minimum desirable level

UNIT 4 -Special Antennas and Antenna Measurements

1. What is yagi uda antenna?

It is an array of driven element, reflectors and one or more directors.

2. What are the different regions in log periodic antenna?

Inactive region, active region and inactive reflective region

3. What are the applications of log periodic antenna?

HF communication, Television reception, All round monitoring

4. Define rhombic antenna

An antenna which consists of four straight wires, arranged in the shape of a diamond, suspended horizontally above the surface of the ground is called rhombic antenna

5. What are the different types of design of rhombic antenna?

- ❖ Alignment design
- ❖ Maximum field intensity design

6. What are the limitations of rhombic antenna?

It needs large space for installation and Due to minor lobes transmission efficiency is low

7. What is a long wire antenna?

The antennas in which there is no reflected wave is called long wire antenna or travelling wave antenna

8. What are the various modes of operation of helical antenna

The two modes are

- o Normal mode
- o Axial mode

9. What is a monofilar helical antenna?

An antenna constructed by a single conductor is called monofilar helical antenna.

10. What are the advantages of helical antenna?

- o Very simple
- o Higher directivity
- o Wideband operation is possible
- o Circular polarization is obtained

11. What is multifilar helix?

An antenna constructed with more than one conductor is called multifilar helix

12. State the principle of operation of a turnstile antenna

Two half wave dipoles placed at right angles to each other in the same phase are excited 90 degree out of phase with each other and produces circular pattern in the plane of turnstile

13. What are the applications of turnstile antenna

- FM transmission
- Television broadcasting

14. What is biconical antenna?

The biconical antenna is a double cone antenna which is driven by potential, charge or an alternating magnetic field at the vertex. In this antenna both the cones face in the opposite direction.

15. What are the parameters in designing the helical antenna

- Beamwidth
- Gain
- Axial ratio
- Impedance

16. What are the two types of feed for turnstile antenna?

1. Two dipoles are connected to separate non resonant lines of unequal length
2. By introducing reactance in series with one of the dipoles, quadrature phase currents are produced.

17. What are the two methods for impedance measurements?

- ❖ Bridge method for low frequencies
- ❖ Slotted line or standing wave method for high frequencies

18. How are spherical waves obtained?

When a voltage V is applied at the input terminals of a biconical antenna, it will produce outgoing spherical waves. The biconical antennas act as guide for spherical waves

19. What are the applications of microstrip patch antenna

- ❖ Used in spacecraft and aircraft engines
- ❖ Used for beam steering and beam scanning

20. what is multifilar helix?

An antenna constructed with more than one conductor is called multifilar helix

Unit 5 Radio wave propagation

1. Define Sky wave.

Waves that arrive at the receiver after reflection in the ionosphere is called sky wave.

2. Define Tropospheric wave.

Waves that arrive at the receiver after reflection from the troposphere region is called Tropospheric wave. (ie 10 Km from Earth surface).

3. What are the type of Ground wave.

Ground wave classified into two types.

- i. Space wave
- ii. Surface wave.

4. What is meant by Space Wave?

It is made up of direct wave and ground reflected wave. Also includes the portion of energy received as a result of diffraction around the earth surface and the reflection from the upper atmosphere.

5. What is meant by Surface Wave?

Wave that is guided along the earth's surface like an EM wave is guided by a transmission is called surface wave. Attenuation of this wave is directly affected by the constant of earth along which it travels.

6. What is meant by fading?

Variation of signal strength occur on line of sight paths as a result of the atmospheric conditions and it is called .It can not be predicted properly.

Two types. i. Inverse bending.

- ii. Multi path fading.

7. What is meant by Faraday's rotation?

Due to the earth's magnetic fields, the ionosphere medium becomes anisotropic and the incident plane wave entering the ionosphere will split into ordinary and extra ordinary waves/modes. When these modes re-emerge from the ionosphere they recombine into a single plane wave again. Finally the plane of polarization will usually have changed, this phenomenon is known as Faraday's rotation.

8. What are the factors that affect the propagation of radio waves?

- i. Curvature of earth.
- ii. Earth's magnetic field.
- iii. Frequency of the signal.
- iv. Plane earth reflection.

7. Define gyro frequency.

Frequency whose period is equal to the period of an electron in its orbit under the influence of the earth's magnetic flux density B.

8. Define critical frequency.

For any layer, the highest frequency that will be reflected back for vertical incidence

9. Define Magneto-Ions Splitting.

The phenomenon of splitting the wave into two different components (ordinary and extraordinary) by the earth's magnetic field is called Magneto-Ions Splitting.

10. Define LUHF.

The lowest useful HF for a given distance and transmitter power is defined as the lowest frequency that will give satisfactory reception for that distance and power. It depends on

- i. The effective radiated power
- ii. Absorption character of ionosphere for the paths between transmitter and receiver.
- iii. The required field strength which in turn depends upon the radio noise at the receiving location and type of service involved.

11. Define maximum Usable Frequency.

The maximum Frequency that can be reflected back for a given distance of transmission is called the maximum usable frequency (MUF) for that distance.

12. Define skip distance.

The distance within which a signal of given frequency fails to be reflected back is the skip distance for that frequency. The higher the frequency the greater the skip distance.

13. Define Optimum frequency?

Optimum frequency for transmitting between any two points is therefore selected as some frequency lying between about 50 and 85 percent of the predicted maximum usable frequency between those points.

14. Define Ground wave.

Waves propagated over other paths near the earth surface is called ground wave propagation.

15. What is inverse and multi path fading?

Inverse bending may transform line of sight path into an obstructed one. Multi path fading is caused by interference between the direct and ground reflected waves as well as interference between two or more paths in the atmosphere.

16. What is sporadic E LAYER in ionosphere?

The sporadic E layer is an anomalous ionization layer in the atmosphere. It usually occurs in the form of clouds.

17. Define whistlers

They are transient electromagnetic disturbances which occur naturally

18. What is meant by diversity reception?

To minimize the fading and to avoid the multi path interference the techniques used are diversity reception. It is obtained by two ways.

- i. Space diversity reception.
- ii. Frequency diversity reception.
- iii. Polarization diversity.

19. Define Space diversity Reception.

This method exploits the fact that signals received at different locations do not fade together.

20. Define frequency diversity Reception.

This method takes advantage of the fact that signals of slightly different frequencies do not fade synchronously. This fact is utilized to minimize fading in radio telegraph circuits.