SNS COLLEGE OF TECHNOLOGY

COIMBATORE-35

DEPARTMENT OF ECE

19ECT302- TRANSMISSION LINES AND ANTENNAS

TWO MARKS QUESTIONS & ANSWERS

UNIT I TRANSMISSION LINE THEORY

1. What are the line parameters?

The parameters of a transmission line are:
Resistance (R)
Inductance (L)
Capacitance (C)
Conductance (G)

2. Define the line parameters.

Resistance (R) is defined as the loop resistance per unit length of the wire. Itsunit is ohm/Km
Inductance (L) is defined as the loop inductance per unit length of the wire. Itsunit is Henry/Km
Capacitance (C) is defined as the loop capacitance per unit length of the wire. Itsunit is Farad/Km
Conductance (G) is defined as the loop conductance per unit length of the wire.Its unit is mho/Km.

3. What are the secondary constants of a line? Why the line parameters are called distributed elements?

The secondary constants of a line are: Characteristic Impedance Propagation Constant Since the line constants R, L, C, and G are distributed through the entire length of the line, they are called as distributed elements. They are also called as primary constants.

4. Define Characteristic impedance

Characteristic impedance is the impedance measured at the sending end of the line. It is given by

$$Z_0 = Z/Y,$$

Where $Z = R + j\omega L$ is the series impedance $Y = G + j\omega C$ is the shunt admittance

5. Define Propagation constant

Propagation constant is defined as the natural logarithm of the ratio of the sending end current or voltage to the receiving end current or voltage of the line. It gives the manner in the wave is propagated along a line and specifies the variation of voltage and current in the line as a function of distance.

6. What is a finite line? Write down the significance of this line?

A finite line is a line having a finite length on the line. It is a line, which is terminated, in its characteristic impedance (ZR=Z0), so the input impedance of the finite line is equal to the characteristic impedance (Zs=Z0).

7. What is an infinite line?

An infinite line is a line in which the length of the transmission line is infinite.A finite line, which is terminated in its characteristic impedance, is termed as infinite line. So for an infinite line, the input impedance is equivalent to the characteristic impedance.

8. What is wavelength of a line?

The distance the wave travels along the line while the phase angle is changing through radians is called a wavelength.

9. What are the types of line distortions?

The distortions occurring in the transmission line are called waveform distortion or line distortion.

Waveform distortion is of two types:

a) Frequency distortion
b) Phase or Delay Distortion.

10. How frequency distortion occurs in a line?

When a signal having many frequency components are transmitted along the line, all the frequencies will not have equal attenuation and hence the received end waveform will not be identical with the input waveform at the sending end because each frequency is having different attenuation. This type of distortion is called frequency distortion.

11. How to avoid the frequency distortion that occurs in the line?

In order to reduce frequency distortion occurring in the line,

a) The attenuation constant α should be made independent of frequency.
b) By using equalizers at the line terminals which minimize the frequency distortion.
c) Equalizers are networks whose frequency and phase characteristics are adjusted to be inverse to those of the lines, which result in a uniform frequency response over the desired frequency band, and hence the attenuation is equal for all the frequencies.

12. What is delay distortion?

When a signal having many frequency components are transmitted along the line, all the frequencies will not have same time of transmission, some frequencies being delayed more than others. So the received end waveform will not be identical with the input waveform at the sending end because some frequency components will be delayed more than those of other frequencies. This type of distortion is called phase or delay distortion.

13. How to avoid the delay distortion that occurs in the line?

Coaxial cables are used to avoid delay distortion. In such cables internal inductance is low at high frequencies because of skin effect, the resistance is small because of large conductors and the capacitance is small because of air dielectric with a minimum of spacers.

14. What are Equalizers?

Equalizers are networks whose frequency and phase characteristics are adjusted to be inverse to those of the lines, which result in a uniform frequency response over the desired frequency band, and hence the phase is equal for all the frequencies.

15. What is a distortion less line? What is the condition for a distortion les line?

A line, which has neither frequency distortion nor phase distortion is called a distortion less line. The condition for a distortion less line is RC=LG.

Also,

a) The attenuation constant α should be made independent of frequency.
b) The phase constant β should be made dependent of frequency.
c) The velocity of propagation is independent of frequency.

16. What is the drawback of using ordinary telephone cables?

In ordinary telephone cables, the wires are insulated with paper and twisted in pairs, therefore there will not be flux linkage between the wires, which results in negligible inductance, and conductance. If this is the case, the frequency and phase distortion occurs in the line.

17. How the telephone line can be made a distortion less line?

For the telephone cable to be distortion less line, the inductance value should be increased by placing lumped inductors along the line.

18. What is Loading of a transmission Line?

Loading is the process of increasing the inductance value by placing lumped inductors at specific intervals along the line, which avoids the distortion.

19. What are the types of loading?

a) Continuous loading
b) Patch loading
c) Lumped loading

20. What is continuous loading?

Continuous loading is the process of increasing the inductance value by placing a iron core or a magnetic tape over the conductor of the line.

21. What is patch loading?

It is the process of using sections of continuously loaded cables separated by sections of unloaded cables which increases the inductance value.

22. What is lumped loading?

Lumped loading is the process of increasing the inductance value by placing lumped inductors at specific intervals along the line, which avoids the distortion.

23. Define reflection coefficient

Reflection Coefficient can be defined as the ratio of the reflected voltage to the incident voltage at the receiving end of the line

Reflection Coefficient K=Reflected Voltage at load /Incident voltage at the load K=Vr/Vi

24. Define reflection loss.

Reflection loss is defined as the number of nepers or decibels by which the current in the load under image matched conditions would exceed the current actually flowing in the load.

25. What is Impedance matching?

If the load impedance is not equal to the source impedance, then all the power that are transmitted from the source will not reach the load end and hence some power is wasted. This is called impedance mismatch condition. So for proper maximum power transfer, the impedances in the sending and receiving end are matched. This is called impedance matching.

26. Define the term insertion loss

The insertion loss of a line or network is defined as the number of nepers or decibels by which the current in the load is changed by the insertion.

Insertion loss=Current flowing in the load without insertion of the network/Current flowing in the load with insertion of the network.

27. When reflection occurs in a line?

Reflection occurs because of the following cases:

1) when the load end is open circuited
2) when the load end is short-circuited
3) when the line is not terminated in its characteristic impedance

When the line is either open or short circuited, then there is not resistance at the receiving end to absorb all the power transmitted from the source end. Hence all the power incident on the load gets completely reflected back to the source causing reflections in the line. When the line is terminated in its characteristic impedance, the load will absorb some power and some will be reflected back thus producing reflections

.

28. What are the conditions for a perfect line? What is a smooth line?

For a perfect line, the resistance and the leakage conductance value were neglected. The conditions for a perfect line are R=G=0.

A smooth line is one in which the load is terminated by its characteristic

impedance and no reflections occur in such a line. It is also called as flat line.

29. What are the different types of transmission lines?

- Openwire line
- Cable
- Coaxial line
- Waveguide

30. What is called a line of small dissipation?

If resistance R is small, the line is considered one of small dissipation and this concept is useful when lines are employed as circuit elements or where resonant properties are involved.

UNIT II GUIDED WAVES

1. What are guided waves? Give examples

The electromagnetic waves that are guided along or over conducting or dielectric surface are called guided waves.
Examples: Parallel wire, transmission lines

2. What is TE wave or H wave?

Transverse electric (TE) wave is a wave in which the electric field strength E is entirely transverse. It has a magnetic field strength Hz in the direction of propagation and no component of electric field Ez in the same direction.

3. What is TH wave or E wave?

Transverse magnetic (TM) wave is a wave in which the magnetic field strength H is entirely transverse. It has a electric field strength Ez in the direction of propagation and no component of magnetic field Hz in the same direction.

4. What is a TEM wave or principal wave?

TEM wave is a special type of TM wave in which an electric field E along the direction of propagation is also zero. The TEM waves are waves in which both electric and magnetic fields are transverse entirely but have no components of Ez and Hz
.It is also referred to as the principal wave.

5. What is a dominant mode?

The modes that have the lowest cut off frequency is called the dominant mode.

6. Give the dominant mode for TE and TM waves

Dominant mode: TE_{10} and TM_{10}

7. What is cut off frequency?

The frequency at which the wave motion ceases is called cut-off frequency of the waveguide.

8. What is cut-off wavelength?

It is the wavelength below which there is wave propagation and above which there is no wave propagation.

9. Write down the expression for cut off frequency when the wave is propagated in between two parallel plates.

The cut-off frequency, fc = mC/ 2a

10. Mention the characteristics of TEM waves.

a) It is a special type of TM wave
b) It doesn't have either e or H component
c) Its velocity is independent of frequency
d) Its cut-off frequency is zero.

11. Define attenuation factor

Attenuation factor = (Power lost/ unit length)/(2 x power transmitted)

12. Give the relation between the attenuation factor for TE waves and TM waves

$\alpha TE = \alpha TM\ (fc/f)2$

13. Define wave impedance

Wave impedance is defined as the ratio of electric to magnetic field strength Zxy= Ex/ Hy in the positive direction
Zxy= -Ex/ Hy in the negative direction

14. What is a parallel plate wave guide?

Parallel plate wave guide consists of two conducting sheets separated by a dielectric material.

15. Why are rectangular wave-guides preferred over circular wave-guides?

Rectangular wave-guides preferred over circular wave guides because of the following reasons.

a) Rectangular wave guide is smaller in size than a circular wave guide of the same operating frequency

b) It does not maintain its polarization through the circular wave guide

c) The frequency difference between the lowest frequency on dominant mode and the next mode of a rectangular wave-guide is bigger than in a circular wave guide.

16. Mention the applications of wave guides

The wave guides are employed for transmission of energy at very high frequencies where the attenuation caused by wave guide is smaller. Waveguides are used in microwave transmission.Circular waveguides are used as attenuators and phase shifters

RECTANGULAR WAVEGUIDES

1. Whyis circularorrectangularformusedas waveguide?

Waveguides usuallytaketheformofrectangularorcircular cylinders becauseofits simplerformsinuseand less expensivetomanufacture.

2.Whatis anevanescentmode?

Whentheoperatingfrequencyislowerthanthecut-offfrequency,thepropagationconstantbecomesreali.e.,Thewavecannotbepropagated. This non-propagatingmodeis knownas evanescentmode.

3. Whatis thedominantmodefortheTE waves intherectangularwaveguide?

ThelowestmodeforTE waveis TE_{10}(m=1,n=0)

4.Whatisthe dominantmodefortheTMwaves intherectangularwaveguide?

ThelowestmodeforTM waveis TM_{11}(m=1,n=1)

5.Whatisthe dominantmodeforthe rectangularwaveguide?

ThelowestmodeforTEwaveisTE_{10}(m=1,n=0)whereasthelowestmodeforTMwaveisTM_{11}(m=1, n=1).TheTE_{10}waves have thelowestcutofffrequencycomparedtotheTM11mode.Hence theTE_{10}(m=1,n=0)isthedominantmodeof arectangularwaveguide. Because theTE_{10}modehasthelowest attenuationofallmodesinarectangularwaveguideanditselectricfieldisdefinitelypolarizedinone directioneverywhere.

6. Whichare thenon-zerofieldcomponents for thefortheTE$_{10}$modeinarectangularwaveguide?

H_x,$H_z$andE_y.

7.Whichare the non-zerofieldcomponents forthefortheTM$_{11}$modeinarectangularwaveguide?

H_x,H_y,E_y.and E_z.

8.Definecharacteristicimpedanceinawaveguide.

Thecharacteristicimpedance $Z_o$canbedefinedinterms ofthevoltage-currentratioorinterms ofpower transmittedforagivenvoltageoragivencurrent. $Z_o(V,I) = V/I$

9. WhyTEMmodeis notpossibleinarectangularwaveguide?

SinceTEM wavedonothaveaxialcomponentofeitherE orH ,itcannotpropagatewithinasingleconductor waveguide

10. ExplainwhyTM$_{01}$and TM$_{10}$modes inarectangularwaveguide donotexist.

ForTM modesinrectangularwaveguides,neithermorncanbezerobecauseallthefieldequations vanish (i.e.,H_x,H_y,E_y.andE_z.=0). Ifm=0,n=1orm=1,n=0nofields arepresent.HenceTM$_{01}$and TM$_{10}$modesina rectangularwaveguidedonotexist.

11.Whatare degeneratemodes inarectangularwaveguide?

Someofthehigherordermodes,havingthesamecutofffrequency,are calleddegenerateModes. Ina rectangularwaveguide,TE$_{mn}$andTM$_{mn}$modes

UNIT III ANTENNA FUNDAMENTALS AND ANTENNA ARRAYS

1) Define Radiation pattern.

An antenna radiation pattern is defined as a mathematical function or graphical representation of the radiation properties of the antennas function of space coordinates. The radiation properties include power flux density, radiation intensity, Field strength, directivity, phase or polarization **(NOV/DEC- 2013)**

2) 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). **(NOV/DEC- 2012)**

3) 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. **(NOV/DEC- 2013)**

4) What is an Infinitesimal Dipole?

When the length of the short dipole is vanishing small, then such a dipole is called an infinitesimal dipole. If dl is the infinitesimally small length and I be the current, then Idl is called as the current element. **(MAY/JUNE – 2013)**

5) Give the expression for the effective aperture of a Half wave Dipole.

The effective aperture of a half wave dipole is given by $A_e = 0.13\lambda^2$
(MAY/JUNE – 2013)

6) 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). **(NOV/DEC – 2011)**

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1) What is meant 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 is given as,

$$[I] = I_{msinw}\left(t-\frac{r}{c}\right)$$

Where, r-Distance travelled
c- Velocity of propagation.

2) 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 currentelement only. It represents the energy stored in the magnetic field surrounding the current element or conductor. This field is also known as near field.

3) 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.

4) 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. The two fields will thus have equal amplitude at that particular distance. This distance is given by $r = 0.159\lambda$

5) Define Radiation Resistance.

It is defined as the fictitious resistance which when inserted in series with the antenna will consume the same amount of power as it is actually radiated. The antenna appears to the transmission line as a resistive component and this is known as the radiation resistance.

6) What is capacitance hat?

The capacitance hat is circular in shape with mast at the center of the circle. There are number of horizontal conducting wires with their ends joined together by means of a ring. The capacitance at is used to increase the electrical length of low frequency antennas.

7) Define top loading.

Top loading is a method to increase the effective capacitance at the top of the antenna. This is accomplished by mounting one or more horizontal conductors at the top of the antenna.

8) Define retardation time.

It is the time required for the wave to propagate over the distance r. Itis given by r/c where c is the velocity of light which is given as $3x10^8$m/s.

9) What is magnetic vector potential?

The source for magnetic vector potential is current element. The current having both magnitude and direction. Hence the potential in the case of magnetic field is magnetic vector potential. The expressions for magnetic vector potential (A) is given as,

$$A = \int \frac{\mu}{4\pi}\left(\frac{J}{r}\right) dv$$

Where, J- current Density, r- Distance.

10) Define electric scalar potential.

The source for producing an electric potential is charge. The charge is having magnitude only. Hence the potential in the case of electric charge is electric scalar potential, E=V, Unit is Weber/m^2

11) Write down the expressions for magnetic vector potential using three standard current distributions.

i) Volume current, $A = \frac{\mu}{4\pi} \oint \frac{Jdv}{r} wb/m^2$

ii) Line current, $A = \frac{\mu}{4\pi} \oint \frac{Idl}{r} wb/m^2$

iii) Surface current, $A = \frac{\mu}{4\pi} \oint \frac{Kds}{r} wb/m^2$.

12) What is retarded current?

Since current flowing through a short dipole is assumed to be constant throughout its length, the effect of this current is not felt instantaneously at a distant point P, but only after an interval equal to the time required for the wave to propagate over a distance r. This current is called as retarded current. Expressions for retarded current,

Where, r/c – retardation time.

$$[I] = I_0 e^{jw\left(t-\frac{r}{c}\right)}$$

13) State reciprocity principle.

If a current I_1 at the terminals of antenna no.1 induces an emf E_{21}attheopen terminals of antenna no.2 and a current I_2 at the terminals of antenna no.2 induces an emf E_{12} at the open terminals of antenna no.1then $E_{12}=E_{21}$ provided $I_1=I_2$.

14) What are the two types of radiation pattern?

•Field pattern

If the radiation from the antenna is expressed in terms of the field Strength (either E or H) then the radiation pattern is called as field pattern.

•Power pattern

If the radiation from the antenna is expressed in terms of power per unit area, then the resultant pattern is power pattern.

15) Define Induction field (near field)?

The field which predominates at the points closer to the current element where r is small is known as induction field. The near field is inversely proportional to square of the distance ($1/ r^2$).

16) 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.

17) 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.

18) 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.

19) Define Beam efficiency.

The total beam area (Ω_A) consists of the main beam area (Ω_M) plus the minor lobe area (Ω_m) . Thus $\Omega_A= \Omega_M+\Omega_m$. The ratio of the main beam area to the total beam area is called beam efficiency. Beam efficiency = $\varepsilon_M=\Omega_M/ \Omega_A$.

20) Define Directivity.

The directivity of an antenna is equal to the ratio of the maximum power density $P(\theta,\varphi)_{max}$ to its average value over a sphere as observed in the far field of an antenna.

$D= P(\theta,\varphi)_{max}/ P(\theta,\varphi)_{av}$ .Directivity from Pattern.

$D=4 \pi / \Omega_A$. Directivity from beam area (Ω_A).

21) 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.

22) What are the field zones?

The fields around an antenna can be divided into two principal regions. Near field zone (Fresnel zone) far field zone (Fraunhofer zone)

23) What is 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. Polarization can be classified into three types. They are

- •Elliptical polarization
- •Circular polarization
- • Linear polarization.

24) 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

$$FBR = \frac{\text{Power radiated in desired direction}}{Power\ radiated\ in\ the\ opposite\ direction}$$

25) 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.

$$Antenna\ efficiency = \frac{power\ radiated}{Total\ input\ power}$$

26) What is radiation resistance?

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

27) What is meant by Antenna Temperature?

The antenna temperature T_A is defined as the temperature of far field region of space and near surroundings which are coupled to the antenna through radiation resistance.

28) What is 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.

29) 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. i.e

30) Define self impedance.

Self impedance of an antenna is defined as the ratio of voltage to current at a pair of terminals.

$$Gain(G) = \frac{Maximum\ radiation\ intensity\ from\ test\ antenna}{Maximum\ radiation\ from\ the\ reference\ antenna}$$

$$Z11 = R11 + jX11$$

Where R_{11}-Radiation Resistance, X_{11}-Self Reactance

31) Define mutual impedance.

The presence of nearby 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.

32) What is meant by cross field?

Normally the electric field E is perpendicular to the direction of wave propagation. In some situation the electric field E is parallel to the wave propagation that condition is called Cross field.

33) Define axial ratio.

The ratio of the major to the minor axes of the polarization ellipse is called the Axial Ratio. (AR)

34) What is meant by Beam Area?

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

35) How radiations are created from a short Dipole?

The dipole has two equal charges of opposite sign oscillating up and down in a harmonic motion. The charges will move towards each other and electric filed lines were created. When the charges meet at the midpoint, the field lines cut each other and new field are created. This process is spontaneous and so more fields are created around the antenna. This is how radiations are obtained from a short dipole.

36) 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.

37) Why a short dipole is called an oscillating dipole?

A short dipole is initially in neutral condition and the moment a current starts to flow in one direction, one half of the dipole require an excess of charge and the other a deficit because a current is a flow of electrical charge. Then, there will be a voltage between the two halves of the dipole. When the current changes its direction this charge unbalance will cause oscillations. Hence an oscillating current will result in an oscillating voltage. Since, in such dipole, electric charge oscillates, it may be called as Oscillating electric dipole.

ANTENNA ARRAYS

1) What is the principle of the pattern multiplication?

The total field pattern of an array of non isotropic but similar sources is the product of the i) individual source pattern and ii) The array pattern of isotropic point sources each located at the phase center of the individual source having the same amplitude and phase. While the total phase pattern is the sum of the phase patterns of the individual source pattern and array pattern.

2) What is meant by array?

An antenna is a system of similar antennas oriented similarly to get greater directivity in a desired direction.

3) 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.

4) What are the types of array?

- Broad side array.
- End fire array
- Collinear array.

•Parasitic array.

5) 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.

6) 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

7) 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.Omni directional antenna.

8) 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 electromagnetic coupling. Eg.Yagi-Uda antenna.

9) 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.

10) 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 compared to main lobes.

UNIT IV SPEIAL ANTENNAS

1) Difference between Yagi – Uda and Log periodic antenna.

Yagi – Uda antenna	Log Periodic antenna
It is a frequency dependent antenna	It is a frequency independent antenna
It is an array of a driven (active) element, a reflector and one or more directors	Electrical properties of the antenna repeat periodically with logarithm of the frequency.

2) What is LPDA?

LPDA means log periodic dipole array. It is defined as an antenna whose electrical properties repeat periodically with logarithm of the frequency. **(NOV/DEC – 2011)**

3) 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. Lensantennas have excessive thickness at low frequencies.

•Costlier for the same gain and beam width in comparison with reflectors.

(NOV/DEC – 2011)

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1) What are the parameters to be considered for the design of a helical antenna?

The parameters to be considered for the design of a helical antenna are: 1. Bandwidth 2. Gain 3. Impedance 4. Axial Ratio

2) What are the types of radiation modes of operation for a helical antenna?

The two types of radiation modes of operation possible for a helical antenna are:

1. Normal mode of operation
2. Axial mode of operation

3) List the applications of helical antenna.

The applications of helical antenna are:

- It became the workhouse of space communications for telephone, television and data, being employed both on satellites and at ground stations
- Many satellites including weather satellites, data relay satellites all have helical antennas
- It is on many other probes of planets and comets, including moon and mars, being used alone, in arrays or as feeds for parabolic reflectors, its circular polarization and high gain and simplicity making it effective for space application.

4) What is a normal mode of helix antenna?

Radiation field is maximum in the direction normal to the helix axis wave is nearly or exactly circularly polarized wave. Mode is said to be normal if the dimensions of helix is small compared with the wavelength.

5) What is a axial mode of helix antenna?

Radiation field is maximum in the end fire direction (ie) along the helix axis & polarization is circular or nearly circular.

6) How the axial mode is improved?

When the helix circumference D & spacing S of order of one wavelength. Axial mode of radiation is produced by raising helix circumference (c/G) of order of one wavelength & spacing is approximately of G/a.

7) What is the error introduced in direction finding of loop antenna?

Antenna or Vertical effect, Night effect or aero plane effect or polarization error.

8) What is an "array factor"?

It is apparent that the total field of an array is equal to equal field of a single element positioned at the origin multiplied by a factor which is widely referred as array factor.

9) What are the advantages of binomial arrays?

- As HPBW increases and hence directivity decreases.
- For design of a large array, larger amp ratio of sources is required.

10) What is the disadvantage of a binomial array?

A major practical disadvantage of binomial array is the wide variations between the amplitudes of the different elements of an array, especially for an array with a large no of elements. This leads to very low efficiencies, and makes this method not very desirable in practice.

11) What is a binomial array?

The coefficients of binomial expansion represent relative amplitudes of the elements. Since the coefficients are determined from the binomial series, expansion the array is known as binomial array.

12) Mention about frequency independent antenna.

Log periodic antenna is a frequency independent antenna. It includes active region and reflective region.

13) What is Yagi Uda antenna?

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

14) What is meant by parasitic element?

The passive elements which are not connected directly connected to the transmission line but are electrically coupled are called as parasitic elements.

15) What is meant by driven elements?

Driven elements are an active element where the power from the transmitter is fed or which feeds the received power to the receiver.

16) Why folded dipole antenna is used in Yagi antenna?

The folded dipole has high input impedance. If the distance between the driven and parasitic element is decreased, it will load the driven element so input impedance of driven element reduces. But this will be compensated.

17) What is beam antenna?

If three-element array are used then such a type of Yagi – Uda is referred to as beam antenna.

18) What is a frequency independent antenna?

An antenna in which the impedance, radiation pattern and directivity remain constant as a function of frequency is called as frequency independent antenna. E.g., Log periodic antenna.

19) What are the different regions in log periodic antenna and how are they differentiated?

- Inactive region – L< l
- Active region – L» l
- Inactive reflective region – L>l

20) What are the applications of log periodic antenna?

- HF communication
- Television reception
- All round monitoring

21) What are the applications of rhombic antenna?

- HF transmission and reception
- Point to point communication.

22) Define rhombic antenna.

An antenna which consists of four straight wires arranged in the shape of diamond, suspended horizontally above the surface of the earth is called as a rhombic antenna. It is otherwise called as diamond antenna or traveling wave antenna.

23) What are the two types of rhombic antenna design?

- Alignment design
- Maximum field intensity design

24) What are the limitations of rhombic antenna?

- It needs a larger space for installation
- Due to minor lobes transmission efficiency is low.

25) Define lens antenna.

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

26) What are the different types of lens antenna?

•dielectric lens or H plane metal plate lens
•E plane metal plate lens antenna

27) What is a dielectric lens antenna?

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

28) 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 thisantenna both the cones face in the opposite direction.

29) What is Lunenburg lens?

The Lunenburg lens is a spherical symmetric delay type lens formed from a dielectric with index of refraction 'n' which varies as a function of radius .

30) What are the advantages of lens antenna?

•the lens antenna, 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 a beam is required to be moved angularly with respect to the axis

31) Mention the uses of lens antenna.

•Unstepped dielectric lens is a wide band antenna as its shape does not depend on the wavelength and hence it can be used over a wide frequency range, however this is not true for the dielectric lens antenna which is frequency sensitive.

•Both reflectors and lens antenna are commonly used above 1000MHz. Lens antenna is a microwave device. So it is preferred to be usually above 3000 MHz and not below it.

UNIT V ANTENNA MEASUREMENTS AND 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. (i.e. 10 Km from Earth surface).

3) Define Ground wave.

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

4) What are the types of Ground wave?

Ground wave classified into two types.

•Space wave •Surface wave.

5) 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.

6) 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.

7) What is meant by fading?

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

8) What is meant by diversity reception?

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

- •Space diversity reception.
- •Frequency diversity reception.
- •Polarization diversity.

9) Define Space diversity Reception.

This method exploits the fact that signals received at different locations do not fade together. It requires antenna spaced at least 100 l apart are referred and the antenna which high signal strength at the moment dominates.

10) 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.

11) Define polarization diversity reception.

It is used in normally in microwave links, and it is found that signal transmitted over the same path in two polarizations have independent fading patterns. In broad band dish antenna system, Polarization diversity combinedwith frequency diversity reception achieves excellent results.

12) What are the factors that affect the propagation of radio waves?

- •Curvature of earth.
- •Earth's magnetic field.
- •Frequency of the signal.
- •Plane earth reflection.

13) Define Magneto-Ions Splitting.

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

14) 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

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

15) Define Refractive index.

It is defined as

$$n = \frac{c}{v_p} = \frac{\text{Velocity of light in vaccum}}{\text{Phase velocity in medium}}$$

16) 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.

$$MUF = f_c \sec F_i$$

17) Define skip distance.

The distance with in 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.

18) 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.

19) Name the possible modes of propagation.

- •Ground wave propagation
- •Sky wave propagation
- •Space wave propagation.

20) What is free space?

Free space is the space which does not interfere with the normal radiation and propagation of radio waves. In free space no magnetic or gravitational fields or solid bodies or ionized particles are assumed to exist.

21) What is diffraction?

The bending of the path of Electromagnetic waves around the sharp edges and corners of obstacles appearing in their path is known as diffraction.

22) What is Tropospheric Scatter?

Troposcatter is a mechanism by which propagation is possible by the scatter and diffracted rays. This scattering takes place in the tropospheric region.

23) Define Whistlers.

- •It is a whistling tone with gradually falling pitch.
- •It occurs due to transient EM disturbances.

24) What are the types of Whistlers?

- •Long Whistlers
- •Short Whistlers
- • Noise Whistlers

25) Define Ionosonde.

The measurement of virtual height is normally carried out by means of an instrument called as ionosonde.

26) Define secant law.

$$F_{muf} = F_c \sec i$$

F_{muf} is greater than F_c by a factor seci. This is known as secant law, which gives the maximum frequency used for sky wave communication.

27) Define point to point propagation.

Electromagnetic waves of frequency more than 300MHz are reflected back from ionosphere but they penetrate it. These are otherwise called as Short wave propagation or point to point propagation.

28) Define cutoff frequency.

The frequency at which the attenuation of a waveguide increases sharply and below which a traveling wave in a given mode cannot be maintained. Afrequency with a half wavelength that is greater than the wide dimension of a waveguide.

29) 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.

30) 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.

31) Define critical frequency.

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

$$f_c = 9\sqrt{N_{max}}$$