B.TECH.

THEORY EXAMINATION (SEM–VI) 2016-17

ANTENNA AND WAVE PROPAGATION

Time : 3 Hours   *Max. Marks : 100*

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. **Explain the following:**   10 x 2 = 20

 (a) Why directional antenna efficiency compared with Isotropic antenna, calculate the directivity of isotropic antenna?

 (b) List out which parameters to consider for receiving antenna design.

 (c) What are the disadvantages of binomial array?

 (d) Give the relation for field strength ,at a distance 'd' from transmitting antenna to show that as 'd' increases ,electric field decreases

 (e) Why sky wave propagation is not possible above 30 MHZ..

 (f) List out difference between broadside and end fire array.

 (g) Draw the unidirectional and bidirectional pattern for $U=U_m \cos \theta$

 (h) Find the directivity of an antenna radiator only over half sphere.

 (i) Find out the power gain in db of a paraboloidal reflector of open mouth aperture 10λ.

 (j) Explain HPBW and BWFN ,give relation between them.

SECTION – B

2. **Attempt any five of the following questions:**   5 x 10 = 50

 (a) (i) Define aperture and effective aperture of antenna, If the gain of antenna is reduced to ¼, what will be the effect of aperture.

   (b) Find maximum power received at the distance of 0.5 km over free space 1GHZ . circuit consisting of transmitting antenna with 25 dB gain and receiving antenna with 20 dB gain .input power of transmitting antenna is 150 W.

 (b) Define antenna array .What is meant by the gain of an antenna ?Show that for a linear array of 'N' isotropic point source equal amplitude and spacing, carrying equal currents and in phase ,the normalized field is given by

$$E_{norm} = \frac{1}{N} \frac{\sin N \frac{\varphi}{2}}{\sin \frac{\varphi}{2}}$$

 (c) (i) Define MUF and give its relation(for flat earth) in terms of critical frequency , propagation distance D and height of layer .

   (ii) At what frequency a wave must propagate for the D- region to have an index of refraction 0.5 for N= 100 elec/c.c for D-region.

 (d) (i) Explain the mechanism of radio wave bending by the ionosphere with neat diagram .

   (ii) Explain the structural details of ionosphere with neat diagram.

 (e) (i) Make a detailed comparison between corner reflector and parabolic reflector.

   (ii) Give the statement of reciprocity theorem in terms of antenna and give the relation for   Mutual impedance Z_m between the two antennas.

 (f) (i) Give the relation for far field pattern of binomial array by using the principle of pattern   multiplication.

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(ii) For an end fire array having several half wave length long isotropic radiator is to have   Directivity of 30 .find the array length and width of major lobe .what will be these values for a broadside array.

(g) (i)   Derive far field expression for small loop antenna?

(ii) What is Yagi antenna? Design Yagi antenna of five elemenet for the frequency band of   61-68 MHz.

(h) What is the principle of rhombic antenna? Draw its diagram and explain the design of rhombic antenna to obtain maximum field intensity.

SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3.   **(a)**   Show that the directivity for an ordinary end-fire array of two identical isotropic point sources spaced a distance d is given by

$$D = \frac{2}{1 + \frac{\lambda}{2\pi d} \sin\left(\frac{2\pi d}{\lambda}\right)}$$

(b)   Define beam width of an antenna and show that its directivity is given by

$$D = \frac{41,257}{\theta_E^0 \theta_H^0}$$

4.   **(a)**   Define radiation resistance, Calculate the radiation resistance of short electric dipole with uniform current   and show that

$$R_r = 80 \, \pi^2 \, (L/\lambda)^2$$

(b)   Define the term critical frequency, virtual height ,skip distance, silence zone.

5.   **Write a short note on following:**

(a)   VLF and LF transmitting antenna

(b)   Effect of earth on ground wave propagation.

(c)   Frequency independent conical spiral antenna