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BT-5/DX **8509**

ANTENNA AND WAVE PROPAGATION

Paper : ECE-301(E)

Opt. (i)

Time : Three Hours] [Maximum Marks : 100

Note : Attempt any *five* questions by selecting at least *one* question from each section.

SECTION–I

1. (a) Derive the expression for the gain of a Half Wave Antenna ? 7

(b) Calculate the distance in wavelength at which the radiation component of magnetic field three times the induction field and at what distance is it 50 times ? 5

(c) By assuming that the far field electric field strength produced by a current element IdL is

$$dE_0 = \frac{60\pi\, I dL \sin\theta}{\lambda r}$$

where r and θ are the polar coordinates, show that the total far field electric field amplitude produced by half wave dipole excited by terminal current $I_m \sin\omega t$ is as follows :

$$E_\theta = \frac{60 I_m}{r}\left[\frac{\cos(\pi/2\cos\theta)}{\sin\theta}\right]. \quad 8$$

2. (a) Explain the following antenna parameters :

(i) Antenna Beamwidth.

(ii) Antenna Temperature. 4+4=8

(b) (i) Find gain, beam width and capture area for a parabolic antenna with a 6m diameter dish and dipole fixed at a frequency of 10GHz. 6

(ii) Determine the maximum effective aperture of a beam antenna having a (HPBW) of 30° and 35° in perpendicular planes intersecting in the beam axis. Assume small side lobes. 6

SECTION–II

3. (a) Prove that the directivity of an endfire array of the point sources spaced distance 'd' apart is given by :

$$D(\theta) = \frac{2}{1+\frac{\sin 2\beta d}{2\beta d}}. \quad 8$$

(b) Explain the following regarding Loop Antenna :

(i) Direction Finding.

(ii) Night Error and method to compensate the same.

(iii) Sense Finder Circuit. 4+4+4

4. (a) Explain Principle of Pattern Multiplication with example and necessary diagram. 6

(b) Explain Axial Mode of Helical antenna in detail with necessary diagrams and give the list of its applications. 8

(c) Compare the general characteristics of Yagi and Turnstile Antennas. 6

SECTION–III

5. (a) Find out the length L, width W and half flare angles θ_E and θ_H of pyramidal horn antenna for which the mouth height $h = 15\lambda$. The horn is fed by rectangular waveguide with TE_{10} mode. 6

(b) Explain the Cassegrain feed system in a Paraboloidal reflector antenna. 8

(c) Explain strapping and zoning in a Lens antenna and also give merits and demerits of Lens antenna. 6

6. (a) The rate of energy flow in a plane sinusoidal electromagnetic wave of frequency 15 MHz is 2m W/m^2. A rectangular loop of wire having area $5m^2$ is placed in a field. Calculate the maximum emf in the loop. 7

(b) Give advantages of Log periodic Antenna. 5

(c) Explain Ramsey's principle and give detail of frequency independent planar Log Spiral antenna. 8

SECTION–IV

7. (a) What are modes of wave propagation ? Explain any *three* modes in brief. 12

(b) Give advantages and disadvantages of Tropospheric Scatter/Diffraction. 8

8. (a) Calculate the transmission path distance for an ionospheric transmission that utilize a layer of height 200 km. The angle of elevation of the antenna beam is 20°. The earth's radius can be assumed to be 6370 km. 8

(b) Write short notes on the following :

(i) Virtual Height.

(ii) Maximum Usable Frequency. 6+6
