Roll No. ....   Total Pages : 3

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 :

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

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

    (b) Explain the following regarding Loop Antenna :
        (i) Direction Finding. http://www.kuonline.in
        (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

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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 electro-magnetic 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

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