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BT-5/D-13

ANTENNA AND WAVE PROPAGATION

Paper-ECE-301-E

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt five questions in all, selecting at least one question from each section.*

Section-I

1. (a) Derive the expression for the gain of a half wave antenna. 8

(b) A lossless resonant half-wavelength dipole antenna with input impedance of 73 ohms, is connected to transmission line whose characteristic impedance is 50 ohm. Assuming that the pattern of the pattern of antenna is given approximalety by

$U = B_0 \sin^3\theta$

Find the maximum absolute gain of this antenna. 6

(c) Find the Half-power beamwidth (HPBW) and First-null beamwidth (FNBW), in radians and degrees, for the following normalized radiation intensity 6

$U(\theta) = \cos^2(2\theta)\cos^2(3\theta)\ \{0 \le \theta \le 90°, 0 \le \Phi \le 360°\}$

2. (a) Elaborate the difference between Directional, Omni directional and Isotropic antennas. 8

(b) A resonant half-wavelength dipole is made out of copper ($\sigma = 5.7 \times 10^7$ S/m) wire. 6

Determine the conduction-dielectric (radiation) efficiency of the dipole antenna at f = 100 MHz if radius of wire is $3 \times 10^{-4}\lambda$, and radiation resistance of the $\lambda/2$ dipole is 73 ohms.

[Turn over

(c) The normalized radiation intensity of given antenna is

$U = \sin^2(\theta)\sin^2(\Phi)$

The intensity exists only in the $0 \le \theta \le \pi, 0 \le \Phi \le \pi$ region, and it is zero elsewhere. Find the exact directivity. 6

Section-II

3. (a) What is Chebyshev array ? Discuss its working and advantages. 12

(b) Compare the working of broadside and endfire array. 8

4. (a) Draw and explain the working of loop antenna. 10

(b) Compare structure, radiation pattern and working of yagi and turnstile type of antenna. 10

Section-III

5. (a) Explain working and significance of reflector antenna. 10

(b) Explain the operation and principle of H-plane horn antenna. 10

6. (a) How is the frequency independency achieved in a log periodic antenna. Discuss its design, construction and operation. 15

(b) Write note on Rumsay's principle. 5

Section-IV

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

(b) What do you mean by multipath fading? Explain the sources of multipath fading in indoor communication. 8

8. Explain :

(i) Virtual height

(ii) Critical frequency

(iii) MUF

(iv) Space wave propagation