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No. of Printed Pages—3

EC-504

B. TECH

FIFTH SEMESTER EXAMINATION, 2002-2003

ANTENNA & WAVE PROPAGATION

Time : 2 Hours

Total Marks : 50

Note : Attempt ALL questions.

- (a) Justify or refute any THREE of the following statements :— (3×3)
- (i) Maxwell's curl equations give the basic idea of radiation.
 - (ii) In Hertzian dipole, the radiation and induction fields have equal amplitude at $\frac{\lambda}{2\pi}$ distance.
 - (iii) The radiation resistance of a small wire antenna is the input impedance of the antenna.
 - (iv) For a vertical antenna, the E-plane pattern is the same as the H-plane pattern.
 - (v) The power radiated from the dipole antenna is maximum at right angle to the axis of the antenna.
- (b) Discuss any TWO of the following :— (2½×2)
- (i) Isotropic radiator
 - (ii) Directive gain
 - (iii) Effective length

2. (a) Attempt any ONE of the following :— (6×1)
- (i) Discuss the theory of a N-element uniform linear array and find the ratio of the principal maximum and first secondary maximum.
 - (ii) Find the location of the first nulls on either side of the beam centre for a linear array of 80 in-phase elements fed with equal amplitude current and which are $\frac{\lambda}{2}$ apart.
- (b) Attempt any TWO of the following :— (6×2)
- (i) What is rhombic antenna ? Discuss the maximum E-design of the antenna.
 - (ii) For a 20 turn helical antenna operating at 3 GHz with circumference $\pi D = 10$ cm and spacing between turns 0.3λ , calculate the directivity and HPBW of the antenna.
 - (iii) Determine the required diameter of a parabolic antenna operating at 5 GHz to result in a first nulls beam-width of 10° . Calculate 3 dB beam-width and the power gain.
3. Attempt any THREE of the following :— (6×3)
- (a) Discuss the theory of reflection of radio waves from the ionospheric layer. What do you mean by critical frequency of the layer ?
 - (b) Find the maximum usable frequency of transmission between two stations 500 Km apart, given that electron density of the

reflecting layer is $10^{12} e/m^3$ at an effective height of 240 km.

- (c) What are different modes of radio wave propagation ? Discuss the space wave propagation. What do you mean by fading ?
- (d) Determine the electric field strength at a distance $d = 10$ km over the rocky land with conductivity $\sigma = 1 mS/m$ and relative permittivity $\epsilon_r = 7$ from the 3 MHz transmitter with $E = 1500 mV/m$.
- (e) Find the skip distance for waves of frequency 4.6×10^6 Hz at a time when the maximum ionization in the E-region has a value of $1 \times 10^{11} e/m^3$ at a height of 110 km.

