Roll No.

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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 $\dfrac{\lambda}{2\pi}$ 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 $\dfrac{\lambda}{2}$ 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 $0.3\ \lambda$, 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 $4 \cdot 6 \times 10^6$ 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.

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