(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2486   Roll No. ☐☐☐☐☐☐☐☐☐☐☐

B. Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

ANTENNA AND WAVE PROPAGATION

Time : 2 Hours   *Total Marks : 50*

Note :—Attempt *all* the questions.

1. Attempt *all* parts of this question :—   (2×7=14)

    (i)   A short dipole and half wave dipole have radiation
          resistances 0.4 ohm and 72 ohms. If the former require
          10 A rms current for certain total output power radiated.
          What would be the current required by the later for
          the same output.

    (ii) Define Radiation intensity and power density of an
          antenna.

    (iii) Draw the radiation pattern of a folded dipole antenna.

    (iv) A lossless resonant half wave dipole antenna is connected
          to a transmission line of 50 ohms. Calculate the percent
          of the input power radiated by the antenna.

    (v)   Derive an expression for Electric field intensity in
          spherical co-ordinate system due to current element.

    (vi) Explain reciprocity theorem in brief.

    (vii) A lossless resonant half-wavelength dipole antenna,
          with input impedance of 73 ohms, is connected to a
   transmission line whose characteristic impedance is

50 ohms. Assuming that the pattern of the antenna is given approximately by :

$$U = B_0 \sin^3 \theta$$

find the maximum absolute gain of this antenna.

2. Attempt any *two* parts :—   (6×2=12)

   (i)   Explain Broadside and End-fire array.

   (ii) Calculate the directivity of two element broadside and end-fire arrays with $d = \lambda/2$.

   (iii) Two isotropic antennas form an array as shown in fig. What should be the value of α so that the radiation pattern has a null at $\theta = 30°$? Find the direction of maximum radiation for that value of α.
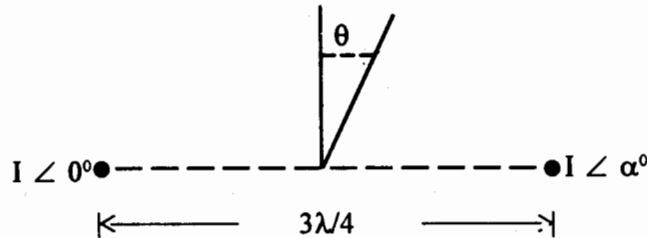
3. Attempt any *two* parts :—   (6×2=12)

   (i)   Derive an expression for received power in LOS wave propagation. If the distance between receiving and transmitting antenna is 10 km and frequency of signal is 10 MHz. Calculate the path loss.

   (ii) Explain ionosphere in detail. The F_1 layer of ionosphere has a height of 400 km and electron density of 10^{11} electrons/m^3. What is the maximum possible elevation angle for a 30 MHz radiation to get reflected from the layer ? What is the skip distance ?

   (iii) Explain in detail :

      (a)   Duct propagation

      (b)   Ground wave propagation.

4. Attempt any *two* parts :—   (6×2=12)

   (i)   How will you feed a parabolic reflector antenna ? Explain spill over, aperture blocking and off-set feed.

   (ii) What is cassegrain antenna ? HPBW of a 6 m parabolic reflector is 0.10 rad. Calculate (i) Gain in dB.

   (iii) Plot the neat sketches for the radiation pattern of the following antennas :—

      (a)   Rhombic antenna

      (b)   Helical antenna (normal mode)

      (c)   LPDA

      (d)   Yagi-Yda.