T.E/VI/PRV/EXTC/Antenna & Wave Propagation/May 05

69-Prav-Exam 1

Con-2544-05. AM-9676

(REVISED COURSE)

(3 Hours) [Total Marks : 100

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **four** from the remaining **six** questions.
(3) **Figures** to the **right** indicate marks.
(4) Assume any **suitable** data whenever **required**.

1. (a) Derive the wave equation in terms of vector potential from the Maxwell's Equations. Also find the solution of wave equation for infinitesimal dipole. 10
   (b) Explain the mechanism of ionospheric propagation. Define the terms critical frequency and MUF. The maximum electron density of the ionospheric layer at 10 MHz occurs when the refractive index is 0·92. Find the range if MUF is 10 MHz and the height of the ray reflection point on the ionospheric layer is 400 400 km. Assume flat earth and negligible effect of earth's magnetic field. 10

2. (a) When a linear dipole is called a infinitesimal dipole or a small dipole or a finite length dipole ? Compare infinitesimal dipole, small dipole and halfwave length dipole in terms of current distribution, radiation resistance, effective length and directivity. 10
   (b) Derive the expressions for electric and magnetic field for a small loop antenna. Compare them with those of infinitesimal electric dipole. 10

3. (a) Define the terms directivity, radiation resistance, radiation efficiency and polarization loss factor of an antenna. 12
   An antenna having a gain of 6 dB over a reference antenna is radiating 700 watts. Calculate the power the reference antenna must radiate in order to be equally effective in most preferred direction.
   (b) The normalised radiation intensity of an antenna is given by 8

$$U = \sin\theta \sin^2\phi \quad \text{for } 0 \le \theta \le \pi,\ 0 \le \phi \le \pi$$
$$= 0 \quad \text{elsewhere}$$

   Find (i) Exact directivity in dtB.
   (ii) Arimuthal and elevation HPBW in degrees.

4. (a) Two point sources carrying current of same phase and magnitude are placed with a distance λ between them. Find the total far field expression, directions of maxima and directions of minima. Plot the pattern. 10
   (b) State and explain principle of pattern multiplication. 10
   Using the above principle plot the pattern for an array of four isotropic sources with a distance of $\frac{\lambda}{2}$ between adjacent elements.

5. (a) Explain the different types of feeds for paraboloidal reflector antenna. 10
   A paraboloidal reflector is required to have a power gain of 1000 at a frequency of 03 Ghz. Determine the mouth diameter and beamwidth of the antenna.
   (b) Explain the structure of microstrip antenna. Find its effective height and directivity. Discuss its applications. 10

6. (a) Explain different types of horn antennas. What are the applications of horn antennas ? 12
   Determine the length L, H plane aperture and flure angles θ_E and θ_H for a pyramidal horn. Eplane aperture $a_E = 10\ \lambda$. $(delta)_E = 0{\cdot}5\ \lambda$. $(delta)_H = 0{\cdot}375\ \lambda$.
   Find the beam width and directivities.
   (b) Compare - 8
      (i) Logperiodic and Yagi Uda array.
      (ii) Rhombic and Loop antenna.

7. (a) Explain space wave propagation. Determine the radio horiton of a space wave propagation if the height of a transmitting antenna is 60 mts and that of receiving antenna is 6 mts. Assume standard atmosphere. 8
   (b) Write short notes on : 12
      (i) Sleeve dipole
      (ii) Tropospheric scatter propagation.