EE301 Tutorial 8 (Antennas)

1. A z-oriented Hertz dipole of 0.1λ length at 10 MHz is located at the origin and excited with 100 A peak current. Find the vector electric and magnetic fields at a distance of 1 m, 100 m and 10 km along the *z*-axis, and in the *xy*-plane.
2. For a 1 MHz Hertz dipole, find the distance beyond which the reactive fields are less than 10% of the radiation fields.
3. Find the solid angle Ω on a spherical surface that is between θ = 20° and θ = 40° and between ϕ = 30° and ϕ = 70°.
4. Find the maximum electric and magnetic field strengths which one would get from a λ/2 dipole at 1 GHz at a distance of 10 km from the dipole. The dipole is excited with 10 A rms current.
5. Find total power radiated by antenna in problem 4.
6. An antenna has a field pattern given by E(θ) = cosθ.cos2θ for 0°≤θ≤90°. Find (a) the half-power beamwidth (HPBW) and (b) the beamwidth between first nulls (FNBW).
7. The field radiation pattern of an antenna is given by
$$F(\theta) = \frac{1}{2}\cos^4\theta, \quad 0 \le \theta \le \frac{\pi}{2}, \quad 0 \le \phi \le 2\pi$$
and zero elsewhere. Find the directivity.
8. The radial component of the radiated power density of an antenna is given by
$$W_{rad} = \hat{a}_r W_r = \hat{a}_r A_0 \sin\theta / r^2 \ (W/m^2)$$
where,
A_0 is the peak value of the power density,
θ is the usual spherical coordinate, and
$\hat{a}_r$ is the radial unit vector.
Determine the total radiated power.
9. Find the expression for radiation resistance of a loop antenna and find its value for a loop antenna with radius of 4.5 cm carrying peak current of 1 A at 1 GHz.
10. Consider the current distribution on a thin λ/2 (= 1m) dipole antenna as [0, 1, 3, 5, 5, 5, 3, 1, 0] mA determined by using MoM formulation. Determine the value of electric field at (2 m, 60^o, 90^o).