Sheet (3)

1. The maximum radiation intensity of a 90% efficiency antenna is 200 mW/ unit solid angle. Find the directivity and gain (dimensionless and in dB) when the
   (a) Input power is 125.66 mW
   (b) Radiated power is 125.66 mW
2. 1GHz satellite antenna has an E-plane beam-width of 12^o and on H-plane beam-width of 10^o. The antenna conductivity and mismatch total loss -3db. Estimate the gain of antenna.
3. 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 $U=B_o\sin^3\theta$. Find the maximum gain and maximum absolute gain of this antenna.
4. Calculate the directivity of an antenna with circular aperture of diameter 3 meter at frequency 5 GHZ.
5. If the aperture efficiency of an antenna is 0.7 and the beam traveling at 6 GHZ. Calculate the directivity, HPBW, and FNBW (approximately). Given circular aperture of diameter 3 meter.
6. What is the maximum effective aperture (approximately) for a beam antenna having HPBW of 30º & 35º in perpendicular planes intersecting in the beam axis? Minor lobes are small and may be neglected.
7. An antenna has a uniform field pattern for θ between (45^o&90^o) ، φ between (0^o & 120^o), if E=3V/m at a distance of 500m from the antenna & Amplitude of current is 5A, find the radiation resistance of antenna, Directivity, and effective aperture?
8. An isotropic antenna has a field pattern given by $E=10\ I_o\ /r$ V/m, where I_o is the maximum current, r is distance (m), find R_r. repeat for hemisphere antenna.
9. Find R_r of a unidirectional pattern of antenna with $U=8\mathrm{Sin}^2\theta\ \mathrm{Sin}^3\varphi$ wsr^{-1}, where $0\leq \theta \leq \Pi$ & $0\leq \varphi \leq \Pi$. If I_{rms} =3A.
10. What is the amplitude of current that would be required in a short dipole of length 0.05λ to produce 100w of radiated power? Assume

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that the medium surrounding the short dipole in air and the current is uniform distribution.

11. What is the max? Power received at a distance of 0.5 Km. over a free-space 1GHZ circuit consisting of a transmitting antenna with 25dB gain and receiving antenna with 20dB gain? The gain is with respect to a lossless isotropic source. The transmitting antenna input is 150W.

12. A wave traveling normally outward from the page (toward the reader) is the resultant of two elliptically polarized waves, one with components of E given by:

$$\mathscr{E}'_y = 3\cos\omega t$$

$$\mathscr{E}'_x = 7\cos\left(\omega t + \frac{\pi}{2}\right)$$

And the other with components given by:

$$\mathscr{E}''_y = 2\cos\omega t$$

$$\mathscr{E}''_x = 3\cos\left(\omega t - \frac{\pi}{2}\right)$$

(a) What is the axial ratio of the resultant wave?
(b) Does the resultant vector E rotate clockwise or counterclockwise?

13. A wave traveling normally out of the page is resultant two elliptically polarized (EP) waves, one with components E_x = 5Cosωt and E_y=3Sinωt and another with components $E_r=3e^{j\omega t}$ and $E_L=4e^{-j\omega t}$. For the resultant wave, find (a) AR, and (b) the band of rotation and polarization.

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REPORT

1. Design an antenna with omnidirectional amplitude pattern with a half-power beam width of 90°, Express its radiation intensity by $U=\sin^n\theta$. Determine the value of n and attempt to identify elements that exhibit such a pattern. Determine the directivity of the antenna.

2. A uniform plane wave, of is traveling in the positive z-direction. Find the polarization (linear, circular, or elliptical), sense of rotation (CW or CCW), when

(a) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=0$ (b) Ex ≠Ey, $\Delta\varphi=\varphi y-\varphi x=0$
(c) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=\pi/2$ (d) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=-\pi/2$
(e) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=\pi/4$ (f) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=-\pi/4$
(g) Ex =0.5Ey, $\Delta\varphi=\varphi y-\varphi x=\pi/2$ (h) Ex =0.5Ey, $\Delta\varphi=\varphi y-\varphi x=-\pi/2$

3. Calculate the polarization loss factor (PLF)…in db and dimensionless of an antenna whose electric field polarization is expressed as: $\vec{E}_a=(a\hat{x}+a\hat{y})E(r,\theta,\phi)$, when the electric field of the incident wave given by $\vec{E}_i=a\hat{x}E_o(x,y)e^{-jkz}$.

Good Luck

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