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10EC64

Sixth Semester B.E. Degree Examination, June/July 2015
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define: i) Radiation intensity ii) Power density. Derive the relation between these two parameters. **(06 Marks)**

b. Show that the maximum effective aperature of a short dipole antenna is $0.119\ \lambda^2$. **(06 Marks)**

c. Determine the directivity of a system, if the radiation intensity is

i) $U_m \sin\theta \cdot \sin^2\phi$; for $0 \le \theta \le \pi$, $0 \le \phi \le \pi$.

ii) $U_m \sin^2\theta \sin^3\phi$; for $0 \le \theta \le \pi/2$, $0 \le \phi \le 2\pi$. **(08 Marks)**

2 a. State and prove power theorem. How power theorem is applied to find power radiated by an isotropic antenna in terms of it's' radiation intensity? **(06 Marks)**

b. Derive an expression for 'array factor' of an array of n-isotropic sources. **(08 Marks)**

c. A linear antenna array consists of four isotropic sources. The distance between adjacent sources is $\lambda/2$. The power applied to the array is with equal amplitude and a phase difference $-d_r$. Obtain the field pattern and find FNBW and HPBW. **(06 Marks)**

3 a. Derive an expression for radiation resistance of a short electric dipole. **(06 Marks)**

b. Show that the radiation resistance of $\lambda/2$ antenna is 73 ohms. **(06 Marks)**

c. With the help of neat diagrams, explain following antennas:
i) Long-wire antenna ii) Folded dipole antenna. **(08 Marks)**

4 a. Derive the expressions for field strengths E_ϕ and H_θ incase of a small loop. **(08 Marks)**

b. The radius of a circular loop antenna is 0.02λ. How many turns of the antenna will give a radiation resistance of 35Ω? **(06 Marks)**

c. Explain Babinet's principle with illustrations. **(06 Marks)**

PART – B

5 a. Explain different types of rectangular horn antennas. Why flaring of walls of waveguide in case of horn antennas is necessary? **(06 Marks)**

b. Describe a helical antenna with the help of a neat diagram. Explain its two modes of operation with relevant equations. **(08 Marks)**

c. Find number of elements in a log-periodic dipole array with 7dBi gain and a 4 to 1 bandwidth. The scale constant K = 1.2 for apex angle of 15°. **(06 Marks)**

6 a. Explain the construction and working of lens antenna. **(06 Marks)**

b. With neat diagram, explain embedded antenna. **(06 Marks)**

c. Explain following antenna types with neat sketches:
i) Ultra wide band antenna ii) Plasma antenna. **(08 Marks)**

7 a. Derive an expression for space wave field intensity and show that it varies sinusoidally. **(08 Marks)**

b. Explain duct propagation with diagram. **(06 Marks)**

c. A free-space LOS (Line-of-Sight) microwave link operating at 10 GHz consists of a transmit and a receive antenna each having a gain of 25dB. The distance between the two antennas is 30km and the power radiated by the transmit antenna is 10W. Calculate the path loss of the link and the received power. **(06 Marks)**

8 a. Explain the mechanism of ionospheric propagation. Also derive an expression for the refractive index of an ionospheric layer. **(08 Marks)**

b. Discuss the effect of the earth's magnetic field on ionospheric propagation. **(06 Marks)**

c. Calculate the angle of incidence and the maximum single-hop distance for a sky wave reflected from the E-layer with height 'h' = 100 km. **(06 Marks)**

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