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10EC64

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part*
2. Draw diagrams wherever necessary.

PART – A

1 a. What is directivity? Obtain the value of beam area in terms of radiation intensity. **(05 Marks)**

b. What is effective length for an antenna? Obtain the value in the case of λ/2 dipole. **(06 Marks)**

c. Calculate the exact directivity for the following sources having following power patterns:

i) $U = U_m \cdot \sin^2\theta \cdot \sin^3\phi$.

ii) $U = U_m \cdot \sin\theta \cdot \sin^3\phi$.

iii) $U = U_m \cdot \sin^2\theta \cdot \sin^3\phi$.

U has value only for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and is zero else where. **(09 Marks)**

2 a. State and explain power theorems in terms of power density and radiation intensity. **(05 Marks)**

b. Explain the different radiation patterns for an antenna. **(07 Marks)**

c. Derive the expression for the field intensity in the case of 'n' number of isotropic sources with uniform spacing. **(08 Marks)**

3 a. Obtain the electric field intensity in the case of a thin linear antenna. **(10 Marks)**

b. Calculate the value of radiation resistance in the case of a short dipole. **(06 Marks)**

c. Obtain the value of directivity when two isotropic sources oppositely exited. **(04 Marks)**

4 a. Explain with neat diagrams different types of slot antenna and its working concept. **(08 Marks)**

b. Obtain the value of impedance of slot antenna in terms of its complimentary dipole antenna impedance Z_d. **(06 Marks)**

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

PART – B

5 a. Explain various types of horn antennas with neat diagrams. **(06 Marks)**

b. Explain the working of a log-periodic antenna with a neat diagram. **(08 Marks)**

c. Determine the cut-off frequencies and band pass of a log-periodic dipole array with a design factor of 0.7. Ten dipoles are used in the structure, the smallest having a dimension equal to $\frac{l_1}{2} = 0.3\,\text{mtrs}$. **(06 Marks)**

6 a. Explain a yagi-uda antenna structure with a neat diagram. **(07 Marks)**

b. Explain lens antenna and find the radius of curvature (R) in the case of a convex lens. **(07 Marks)**

c. A paraboloid reflector of 1.8mtr diameter is used at 6 GHz. Calculate beam width between the nulls and gain in dB. Area factor for dish is 0.65. **(06 Marks)**

7 a. Derive an expression for field intensity in the case of a space wave propagation. **(10 Marks)**

b. Explain duct propagation. **(05 Marks)**

c. A transmitter radiates 100 watts of power at a frequency of 50MHz in space wave propagation. The transmitting antenna has a gain of 5 and a height of 50mtrs. The receiving antenna height is 2mtrs. It is estimated that a field strength of 100μV/meter is required to give satisfactory signals at the receiver. Calculate the distance between the transmitting and receiving antennas assuming flat earth. **(05 Marks)**

8 a. Explain the mechanism of ionospheric wave propagation. Also derive an expression for the refractive index of ionosphere. **(10 Marks)**

b. Define the terms: i) Critical frequency and ii) Skip distance for ionosphere with neat diagrams. **(05 Marks)**

c. Calculate the value of frequency at which the electromagnetic wave should be propagated in the D-region. It is given that refractive index $\mu = 0.5$ and electron density $N = 10^{12}$ electrons/m^3. **(05 Marks)**

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