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10TE63

Sixth Semester B.E. Degree Examination, June/July 2016
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

Note: 1) *Answer FIVE full questions, selecting at least TWO questions from each part.*
2) *Assume any missing data suitably.*

PART – A

1 a. Define the term antenna aperature. Derive the equation for directivity in terms of aperature. **(06 Marks)**

b. Show that the directivity of a short dipole is 50% greater than the directivity of an isotropic antenna. **(06 Marks)**

c. A lossless resonant $\frac{\lambda}{2}$ dipole antenna having an input impedance of 73 Ω is to be connected to a transmission line having characteristics impedance of 50 Ω. The radiation intensity pattern of the antenna is given by, $U = U_m \sin^3\theta$. Find the overall gain of the antenna. **(08 Marks)**

2 a. State and prove the power theorem. **(05 Marks)**

b. Derive an expression and draw the field pattern for an array of two isotropic point sources of same amplitude and opposite phase. **(07 Marks)**

c. Obtain the field pattern for a linear uniform array of 6 isotropic point sources spaced $\frac{\lambda}{2}$ apart. The power is applied with equal amplitude and in-phase. Also find maxima and sidelobe levels for the pattern and calculate FNBW and HPBW. **(08 Marks)**

3 a. Derive an expression for radiation resistance of short electric dipole. **(08 Marks)**

b. A thin linear short dipole antenna is $\frac{\lambda}{12}$ long. Find the radiation resistance and efficiency of the dipole for loss resistance of 1.2 Ω. **(04 Marks)**

c. Explain following antennas with relevant diagrams: (i) Folded dipole antennas (ii) Long-wire antennas. **(08 Marks)**

4 a. Considering general case derive the far field equations for loop antenna. **(08 Marks)**

b. Explain Babinet's principle with illustration. **(04 Marks)**

c. Derive the equation for impedance of a slot antenna in terms of the impedance of the complementary dipole antenna. **(08 Marks)**

PART – B

5 a. With the help of neat diagrams, explain : (i) Sleeve antenna and (ii) Turnstile antenna. **(08 Marks)**

b. Explain features and practical design considerations of the helical antenna. **(08 Marks)**

c. Design Yagi-Uda antenna of six elements to provide a gain of 12 dBi if the operating frequency is 200 MHz. **(04 Marks)**

6 a. Explain : (i) Ultra wide band antenna.
(ii) Lens antenna. **(10 Marks)**

b. With the help of neat diagrams explain, (i) Parabolic reflectors (ii) Antennas for ground penetrating RADAR. **(10 Marks)**

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

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

c. Determine :
(i) the radio horizon distance for a transmitting antenna height of 300 feet.
(ii) the radio horizon distance of a receiving antenna with a height of 100 feet.
(iii) the maximum range of space wave communication for the above antenna heights. **(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, 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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