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06EC64

Sixth Semester B.E. Degree Examination, June/July 2014

Antenna and Wave Propagation

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the followings with respect to antenna:
i) Radiation pattern
ii) Field zones
iii) Aperture
iv) Directivity **(10 Marks)**

b. Derive the relation between maximum effective aperture and directivity. **(05 Marks)**

c. Calculate directivity using exact method for the radiation intensity:

$$U = U_m \sin^2\theta \sin^3\phi$$

Take: $0 < \theta < \pi/2$, $0 < \phi < 2\pi$ **(05 Marks)**

2 a. Show that the maximum effective aperture of short dipole is equal to $0.119\ \lambda^2$ or D = 1.5 and hence show that the directivity of short dipole is 50% more than an isotropic radiator. **(10 Marks)**

b. Derive an expression and draw the field pattern for an array of two isotropic point sources with equal amplitude and phase. Take separation distance between sources as $\lambda/2$. **(07 Marks)**

c. What are Broadside and End fire arrays? **(03 Marks)**

3 a. Write far fields of center fed dipole. Draw approximate natural current distribution for various thin linear, center fed antennas of different lengths. **(05 Marks)**

b. Derive the radiation resistance of short dipole. **(07 Marks)**

c. Explain basic concept of folded dipole antenna and show how impedance transformation is possible using folded dipole. **(08 Marks)**

4 a. Derive far fields of small loop antenna (radius $a << \lambda$). **(07 Marks)**

b. Write notes on: i) Slot antenna, ii) Rhombic antenna. **(08 Marks)**

c. The radius of a circular loop is 0.02λ. How many turns of the antenna will give a radiation resistance of 35 Ω? **(05 Marks)**

PART – B

5 a. Explain practical design considerations for the monofilar axial mode Helical antenna. **(08 Marks)**

b. Explain different types of rectangular and circular horn antenna. **(06 Marks)**

c. Explain working of log periodic antenna. **(06 Marks)**

6 a. Describe ground wave propagation. **(07 Marks)**

b. Derive the expression for resultant field strength at a point due to space wave propagation. **(08 Marks)**

c. Calculate the wave tilt in degrees of the surface wave over an earth of 6 millimeters conductivity and relative permittivity of 12 at 2 MHz. **(05 Marks)**

7 a. Explain tropospheric scatter phenomenon. **(05 Marks)**

b. Define following terms as related to ionospheric propagation:

i) Maximum usable frequency

ii) Skip distance

iii) Critical frequency

iv) Virtual height **(10 Marks)**

c. In an ionospheric wave propagation the angle of incidence made at a particular layer, at a height of 200 km is 45°, with critical frequency of 6 MHz. Calculate the skip distance. **(05 Marks)**

8 Write notes on:

a. Embedded antenna

b. Parabolic reflector

c. Plasma antenna

d. Antennas for ground penetrating RADAR (GPR) **(20 Marks)**

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