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06EC64

Sixth Semester B.E. Degree Examination, June/July 2013
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Explain basic principle of radiation using basic radiation equation. **(04 Marks)**

b. Explain the following terms as related to antenna systems:
i) Directivity
ii) Effective height
iii) Beam area
iv) Radiation pattern. **(12 Marks)**

c. A radio link has 100 watts transmitter connected to an antenna of $2.5m^2$ effective aperture at 5 GHz. The receiving antenna has a effective aperture of $0.5m^2$ and is located at a 15 km LOS distance. Find the power delivered to the receiver. **(04 Marks)**

2 a. State and explain power theorem and its applications to an isotropic source. **(05 Marks)**

b. Obtain the field pattern for two isotropic point sources with equal amplitude and opposite phase. Assume distance between two sources = $\lambda/2$. **(08 Marks)**

c. Explain the principle of pattern multiplication, with an example. **(07 Marks)**

3 a. Derive an array-factor expression in case of linear array of 'n' isotropic point sources of equal amplitude and spacing. **(10 Marks)**

b. To find peaxs, nulls and beam width of a given system with equal amplitude and equal phase $d = \lambda/2$ and $n = 4$. Draw the field pattern. **(10 Marks)**

4 a. Derive electric and magnetic fields of a short dipole. **(10 Marks)**

b. Show that the radiation resistance of $\lambda/2$ antenna is 73Ω. **(07 Marks)**

c. For a short dipole $\lambda/15$ long. Find the efficiency, the radiation resistance if loss resistance is 1Ω. **(03 Marks)**

PART – B

5 a. Derive the far field expressions for small loop antenna. **(08 Marks)**

b. Write short notes on:
i) Slot antenna
ii) Patch antenna. **(08 Marks)**

c. Find the radiation efficiency of a 1m diameter loop ($c = \pi m$) of 10mm diameter copper wire at i) 1 MHz; ii) 10 MHz. **(04 Marks)**

6 a. Explain the practical design considerations for the monofilar axial mode helical antenna. **(10 Marks)**

b. Determine:
The length L aperture a_H and half angles in E and H planes for a pyramidal e.m horn for which the aperture $a_E = 8\lambda$. The horn is fed with a rectangular wave guide with TE_{10} mode. Take $\delta = \lambda/10$ in the E – plane and $\delta = \lambda/4$ in the H-plane.
i) What is directivity?
ii) What is the aperture efficiency? **(10 Marks)**

7 a. What are the factors affecting ground wave propagation? Explain the Summerfield equation for ground wave propagation. **(10 Marks)**

b. Derive the expression for refractive index of an ionspheric layer. **(10 Marks)**

8 a. Define the following terms as related to ionospheric propagation:
i) MUF
ii) Critical frequency
iii) Virtual height
iv) Skip distance. **(08 Marks)**

b. 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 6 MHz. Calculate the skip distance. **(06 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. **(06 Marks)**

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