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06EC64

Sixth Semester B.E. Degree Examination, December 2012
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following terms with respect to antenna:
i) Antenna Beamwidth ii) Directivity iii) Beam Efficiency **(09 Marks)**

b. Explain the different types of aperture and their relationships. **(06 Marks)**

c. Distinguish the parameters of antenna field zones. **(05 Marks)**

2 a. The radiation intensity of an antenna is given by $u(\theta, \phi) = \cos^4\theta \sin^2\phi$, for $0 \le \theta \le \pi/2$ and $0 \le \phi \le 2\pi$. This zero in the lower half space. Find,
i) Exact directivity in dB ii) HPBW (Half power beam width) **(06 Marks)**

b. Derive an expression and draw the field pattern for an array of two isotropic point sources of same amplitude and opposite phase. Also determine its maxima, minima and HPBW. **(08 Marks)**

c. Calculate the maximum effective aperture of a short dipole. **(06 Marks)**

3 a. Calculate the diversity for the power pattern given as $U = U_m \sin^2\theta \sin^3\phi$, for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and zero elsewhere. **(06 Marks)**

b. Show that effective height of an antenna is given by, $h_e = \sqrt{\frac{A_{e_m} R_v}{30\pi}}$. **(05 Marks)**

c. Illustrate the principle of pattern multiplication with suitable example. **(05 Marks)**

d. State and explain power theorem to point sources. **(04 Marks)**

4 a. Derive the expression for radiation resistance of short dipole. **(07 Marks)**

b. Derive the far field components of short dipole. **(07 Marks)**

c. Four isotropic sources are placed $\frac{\lambda}{6}$ mt apart. They have a phase difference of $\pi/3$ between the adjacent elements. Find the beam width between first nulls. **(06 Marks)**

PART – B

5 a. Show that the radiation resistance of loop antenna is given by

$$31200\left(\frac{nA}{\lambda^2}\right)^2$$ **(08 Marks)**

b. Explain the concept of Babinet's principle with neat figure. **(06 Marks)**

c. Write a note on pyramidal horn antenna with design equation. **(06 Marks)**

6 a. Explain the practical design operation for the monopilar axial mode helical antenna. **(06 Marks)**

b. With neat diagram, explain the operation of log-periodic antenna. **(06 Marks)**

c. Write short notes on : i) Embedded antennas and ii) Ultra-wide band antennas. **(08 Marks)**

7 a. Derive an expression for space wave field intensity. **(08 Marks)**

b. Show that radius of curvature of path is a function of the rate of change of dielectric constant with height in tropospheric propagation. **(08 Marks)**

c. Explain the three factors which affect the propagation of radio waves in an actual environment. **(04 Marks)**

8 a. Explain the structure of the ionosphere and derive an expression for refractive index of ionosphere assuming the value of $\in_r$. **(08 Marks)**

b. Define and derive the expression for the following:
i) Critical frequency ii) Virtual height iii) Skip distance. **(09 Marks)**

c. A radio link is established for a range of 300 km. If the reflection region of ionosphere is at a height of 200 km with critical frequency of 8 MHz, calculate MUF. **(03 Marks)**

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