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06EC64

Sixth Semester B.E. Degree Examination, December 2011
Antenna and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following terms with proper expressions: i) Directivity ii) Field pattern iii) Half power beam width. **(09 Marks)**

b. Show that maximum effective aperture of a $\frac{\lambda}{2}$ dipole is $0.13\ \lambda^2$. **(06 Marks)**

c. A radio link has a 15 W transmitter connected to an antenna of 2.5 m^2 effective aperture at 5 GHz. The receiving antenna has an effective aperture of 0.5 m^2 and is located at a 15 km line of sight distance from the transmitting antenna. Assume lossless antennas. Find the power delivered to the receiver. **(05 Marks)**

2 a. Derive the expression for total field, in case of two isotropic point sources with the same amplitude and equal phase. Plot the field pattern for two isotropic sources spaced $\frac{\lambda}{2}$ apart. **(10 Marks)**

b. For a square having radiation intensity $u = u_m \sin^2\phi \sin^3\phi$, given $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$. Find the directivity by i) Exact method ii) Approximate method **(10 Marks)**

3 a. Explain the principle of pattern multiplication. **(05 Marks)**

b. A linear array consists of 4 isotropic point sources. The distance between the adjacent elements is $\frac{\lambda}{2}$. The power is applied with equal magnitudes and a phase difference –dr. Obtain the field pattern and find BWFN (Beam Width First Null) and HPBW. **(10 Marks)**

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

4 a. Show that the radiation resistance of $\frac{\lambda}{2}$ is 73 ohms. **(06 Marks)**

b. Derive the expressions for the field components of a short dipole, starting with the expression of electric potential and vector magnetic potential. Also determine the far-field component. **(14 Marks)**

PART – B

5 a. Explain Babinet's principle with illustrations. Discuss features of complementary antenna. **(10 Marks)**

b. Write short notes on: i) Horn antenna ii) Loop antenna. **(10 Marks)**

6 a. Explain the features of an helical antenna. Explain the practical design considerations of the helical antenna. **(10 Marks)**

b. Write short notes on a log periodic antenna. **(06 Marks)**

c. A 64 m diameter dish antenna, operating at a frequency of 1.43 GHz is fed by a non-directional antenna. Calculate its i) HPBW ii) BWFN. **(04 Marks)**

7 a. In tropospheric propagation, show that radius of curvature of path is a function of the rate of change of dielectric constant, with height and also explain the duct propagation of wave. **(10 Marks)**

b. Derive the expression for resultant field strength at a point due to space wave propagation. **(10 Marks)**

8 a. Define the following terms as related to ionospheric propagation: i) MUF ii) Critical frequency iii) Virtual height **(06 Marks)**

b. Derive the expression for conductivity, relative permittivity and refractive index as a function of electron density and angular frequency. **(08 Marks)**

c. Explain skip distance and derive the expression for skip distance for flat earth surface. **(06 Marks)**

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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.