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10EC64

Sixth Semester B.E. Degree Examination, Feb./Mar.2022
Antenna & Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following terms with respect to antenna :
(i) Directivity
(ii) Antenna field zones
(iii) Beam efficiency
(iv) Half power beam width
(v) Effective aperture. **(10 Marks)**

b. Derive Frii's formula and find the power delivered to the receiver of a radio link having 150 watts transmitter connected to an antenna of $2m^2$ aperture at 2 GHz. The receiving antenna has an aperture of 1.5 m^2 and is located at 10 km. **(10 Marks)**

2 a. Derive an expression for maximum effective aperture and directivity of $\frac{\lambda}{2}$ dipole. **(07 Marks)**

b. Derive an expression and draw the field pattern for an array of two isotropic point sources with equal amplitude and opposite phase. **(06 Marks)**

c. Explain the principle of pattern multiplication and find directivity of $U = U_m \sin\theta \sin^2\phi$ where $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$. **(07 Marks)**

3 a. Derive an expression for radiation resistance for $\frac{\lambda}{2}$ dipole. **(07 Marks)**

b. Explain long wire antenna and its types. **(08 Marks)**

c. For a short dipole $\frac{\lambda}{10}$ long find the efficiency, radiation resistance if loss resistance is 1 Ω. Find also the effective aperture. **(05 Marks)**

4 a. Derive the expression for the impedance of slot antenna. **(06 Marks)**

b. State Babinet's principle and derive an expression of impedance of complementary screen. **(07 Marks)**

c. Derive an expression for directivity of a circular loop antenna. Also find the directivity for a loop of circumference 1 λ if it is placed $\frac{\lambda}{10}$ distance from ground plane. **(07 Marks)**

PART – B

5 a. Explain with neat diagram of, (i) Yagi-Uda antenna (ii) Parabolic reflector (iii) Log periodic antenna. **(12 Marks)**

b. Explain the types of rectangular horn antenna and determine the length 'L' and directivity in both planes for a pyramidal electromagnetic horn antenna for which aperture $a_E = 8\lambda$. The horn is fed with rectangular waveguide with TE10 mode. Assume $\delta = \frac{\lambda}{10}$ in E-plane and $\delta = \frac{\lambda}{4}$ in H-plane. **(08 Marks)**

6 a. Explain briefly with neat diagram of, (i) Plasma Antenna (ii) Antenna for GPR. **(10 Marks)**

b. Explain helical antenna in its two modes of operations. Also find HPBW and axial ratio of a 16-turn helical beam antenna has a circumference of λ and turn spacing of $\frac{\lambda}{4}$. **(10 Marks)**

7 a. Explain the principle of surface wave propagation and obtain an equation for tilt angle 'α' of the wave. **(10 Marks)**

b. Estimate the wave tilt in degrees of the surface wave over an earth of 5 m℧ conductivity and relative permittivity of 10 at 1 MHz. **(05 Marks)**

c. The transmitter is mounted at a height 100 m. A receiver height of 50 m is mounted at a distance 50 km. Find the space wave field strength at receiving antenna at 150 MHz if the field strength per unit distance in the directivity of receiving antenna is 60 V/m. **(05 Marks)**

8 a. Derive an expression for skip distance. **(06 Marks)**

b. Explain briefly fading and its types. **(10 Marks)**

c. A distance of 1500 one is to be covered along the earth's surface using a communication link. If the reflection region of ionosphere (f_c) has 6 MHz and f_{muf} is 7.5 MHz. Calculate height of the region. **(04 Marks)**

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