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10EC64

Sixth Semester B.E. Degree Examination, June/July 2018
Antenna and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following terms as related to antenna system:
   i) HPBW
   ii) Power density
   iii) Beam solid angle
   iv) Directivity
   v) Radiation resistance **(10 Marks)**

b. Calculate the exact directivity for the following sources:
   i) $u = u_m \sin^2\theta \sin^3\phi$ ii) $u = u_m \sin\theta \sin^3\phi$
   u has value only for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and is zero elsewhere. **(05 Marks)**

c. Define antenna aperture. Derive the relationship between aperture and beam area. **(05 Marks)**

2 a. State and explain power theorems in terms of power density and radiation intensity. **(05 Marks)**

b. Obtain the relative field pattern for an array of two isotropic point sources of same amplitude and opposite phase spaced $\lambda/2$ apart. **(10 Marks)**

c. Find the total power radiated and directivity of an antenna with radiation intensity. $u = u_m \cos^4\theta \sin^{-2}\phi$ for $0 \le \theta \le \pi/2$ and $0 \le \phi \le 2\pi$. **(05 Marks)**

3 a. Write an explanatory note on folded dipole antenna with neat figure. **(06 Marks)**

b. Show that the radiation resistance of $\lambda/2$ antenna is 73Ω. **(09 Marks)**

c. For a short dipole $\lambda/15$ long, find the efficiency, radiation resistance if loss resistance is 1Ω. Find also the effective aperture. **(05 Marks)**

4 a. Write a brief note on patch antenna. **(05 Marks)**

b. The radius of a circular loop antenna is 0.02λ. How many turns of the antenna will give a radiation resistance of 35Ω. **(06 Marks)**

c. What are the salient features of loop antenna? Obtain radiation resistance of a small loop antenna. **(09 Marks)**

PART – B

5 a. With a neat diagram, explain the working of yagi-uda antenna in detail with design formulae. Highlight its applications. **(08 Marks)**

b. A dish antenna operating at a frequency of 1.43GHz has a diameter of 64 metres and is fed by a directional antenna. Calculate HPBW, BWFN and gain with respect to $\lambda/2$ dipole with even illumination. **(05 Marks)**

c. Explain helical antenna with design considerations and working principle. Also highlight the applications of the antenna. **(07 Marks)**

6 a. Briefly write about various types of horn antennas with neat diagrams. **(05 Marks)**

b. Explain the working of log periodic antenna. **(05 Marks)**

c. Write short notes on:

i) Embedded antenna

ii) Ultra wide band antenna. **(10 Marks)**

7 a. Derive an expression for 'Line of Sight' distance (LOS) between transmitting and receiving antennas. **(06 Marks)**

b. Define wave tilt of a surface wave propagation. Also, prove that wave tilt,

$$\alpha = \tan^{-1}\frac{E_n}{E_v} = \tan^{-1}\left[\frac{1}{\sqrt{\epsilon_r}\,[1+x^2]^{1/4}}\right].$$ **(10 Marks)**

c. Explain duct propagation in brief. **(04 Marks)**

8 a. Define the following as related to ionospheric propagation with standard formulaes:
i) Virtual height ii) Critical frequency iii) Maximum usable frequency. **(09 Marks)**

b. Calculate the value of frequency at which the electromagnetic wave should be propagated in D-region given that refractive index $\mu = 0.5$ and electron density $\gamma = 10^{12}$ electrons/m^3. **(05 Marks)**

c. In an ionospheric wave propagation, the angle of incidence made at a particular layer at the height of 200km is 45°, with critical frequency 6MHz. Calculate the skip distance. **(06 Marks)**

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