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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; June/July - 2015

Antennas and Wave 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. A thin dipole is $\frac{\lambda}{15}$ long with $R_r = 80\pi^2\left(l/\lambda\right)^2$ it has loss resistance of 1.5 Ω, find: (i) directivity D (ii) gain G (iii) effective aperture A_e (iv) beam solid angle Ω (v) radiation resistance R_r (vi) Terminal resistance — 10

b. In a microwave communication link, two identical lossless antenna operating at 10 GHz are used with power gain of 40 dB. If the transmitter power is 1W, find the received power, if the range of the link is 30 km. — 5

c. Prove that the directivity for a source with a unidirectional power pattern is given by $U = U_m\cos^n\theta$ can be expressed as $D_n = 2(n+1)$. 'U' has a value for $0 \le \theta \le \frac{\pi}{2}$ and $0 \le \phi \le 2\pi$. — 5

2 a. Show that the width of the principle lobe of an end-fire array is greater than that of broad side array of the same spacing between the sources, derive the equations and justify with example. — 8

b. Derive an expression for resultant field of an array of N-isotropic sources. — 6

c. Explain the principle of pattern multiplication with example. — 6

3 a. A vertical wire of 1 m length carries a current of 1 A at 10 MHz. Calculate;
(i) Radiated field strength: E_θ and H_ϕ at a distance of 500 km.
(ii) The total power radiated: P_{max} and P_{avg}.
(iii) The radiation resistance. — 5

b. The current fed at the centre of a $\frac{\lambda}{2}$ dipole is 2.5 A (RMS). Find the electric field strength in a direction 60° from the axis of dipole at the distance of 10 km. — 4

c. Show that radiation resistance of $\frac{\lambda}{2}$ dipole is 73 Ω. — 6

d. Define folded dipole. Derive its input impedance. — 5

4 a. A loop aerial operating at 500 kHz of height 0.5 m, width 0.5 m and 25 turns, when directed to receive a maximum signal, the emf induced in the loop is 150 μV. Estimate the field strength of received signal. — 5

Contd…2

b. Calculate the radiation resistance of a single turn and eight –turn small circular loop when the radius of the loop is $\frac{\lambda}{25}$ and the medium is free space. 5

c. Explain the Babinets's principle for complementary antennas. 5

d. Briefly explain patch antenna 5

PART - B

5.a. Explain the necessity of flaring of walls of waveguide in case of Horn antennas and find the equation for flare angle. 6

b. Discuss the geometry of helical antenna and its modes of operation. 8

c. Write an explanatory note on log periodic antenna. 6

6 a. Explain working principle of parabolic reflector. 5

b. Explain mobile station antennas for terrestrial mobile communication. 6

c. Write short notes of on the following : 9

i) Antennas for GPR systems

(ii) Plasma antennas

(iii) Embedded antennas

7 a. Explain Electromagnetic wave propagation by means of diffraction. 6

b. Explain when surface wave propagation occurs and discuss the dependence of ground attenuation factor with numerical distance. 8

c. Explain with the help of a neat sketch the troposcatter mode of wave propagation. 6

8 a. Derive an expression for refractive index of ionosphere. 10

b. Calculate the electrons density required to return a signal at 10 MHz incident on the bottom of layer at an angle of 26^{o} to the normal. 4

c. Explain the following terms with respect to ionosphere propagation; 6

(i) Virtual height

(ii) Skip distance.

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