Code: 13A04501 **R13**

B.Tech III Year I Semester (R13) Regular Examinations December 2015

ANTENNAS & WAVE PROPAGATION

(Electronics and Communication and Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Radiated power density of an antenna is given by $A_0 Sin\theta/r^2\ \hat{a}_r$ W/m^2. Find the maximum directivity of the antenna.

(b) Explain the terms "Radian" and "Steradian" with reference to the radiation pattern of antennas.

(c) A magnetic field strength of 5 μA/m is required at a point on $\theta = \pi/2$ which is 2 km from an antenna in air. Neglecting ohmic losses, how much power must the antenna transmit if it is a half-wave dipole?

(d) Draw the E – plane view and H – plane view of a pyramidal horn antenna specifying important parameters required for the design of the antenna.

(e) List out advantages and limitations of Microstrip antennas.

(f) Assuming perpendicularly polarized feeds, draw the corner reflectors and their images for angles of 90^0 & 45^0.

(g) Distinguish the differences between broadside array and end-fire array.

(h) Give the different field regions of an antenna & specify them graphically with respect to antenna's position.

(i) Calculate the distance beyond which the earth's curvature is to be accounted at a signal frequency of 10 MHz.

(j) Calculate the maximum single hop distance for 'D' and 'E' layers if their heights are assumed to be 70 and 130 km respectively above the earth & the angle of incidence is 10^0 for both cases.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Derive the expression for radiation resistance of a short (Hertzian) electric dipole starting from far field expressions.

(b) Explain about different polarizations with suitable expressions and sketches.

OR

3 (a) State and explain the following antenna parameters: (i) Directivity. (ii) Half Power Beam Width (HPBW) with suitable examples.

(b) A half-wave dipole is located on a perfectly conducting ground with sinusoidal current distribution. Deduce the expression for average power radiated by the dipole.

UNIT – II

4 (a) Derive far field expressions due to a small filamentary circular loop of radius 'a' carrying uniform current of $I_0 \cos(\omega t)$.

(b) With neat sketches, discuss about the folded dipole and its input impendence.

OR

5 (a) Explain the working principle of Yagi – Uda antenna with suitable sketches.

(b) Discuss about design considerations of pyramidal horn antenna.

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UNIT – III

6 (a) What are the characteristics of Microstrip antennas? Explain in detail.
(b) State first null beam width, and find out its value and power gain(in dBs) of 2 m paraboloid reflector operating at 6 GHz.

OR

7 (a) Discuss about different structures of dielectric lenses, & their principle of operation with neat sketches.
(b) A parabolic dish provides a gain of 75 dB at a frequency of 15 GHz. Calculate capture area of the antenna and half power and first null beam widths.

UNIT – IV

8 (a) Deduce the expression for the Array Factor due to an N-element uniform linear antenna array and draw its plot for N = 4.
(b) With suitable block diagram, give the steps to measure radiation pattern of an antenna considering E-plane & H – plane.

OR

9 (a) With the suitable setup, explain the measurement of Gain of an antenna by absolute and by comparison methods.
(b) Consider two Hertzian dipoles are placed in free space along the z-axis but oriented parallel to the x-axis. For the two element antenna specified above, sketch the normalized field pattern when currents are fed in phase and the distance between them $d = \lambda/2$.

UNIT – V

10 (a) Derive the expression for maximum usable frequency (MUF) pertaining to sky wave propagation.
(b) A transmitting antenna of 100 m height radiates 40 kW at 100 MHz uniformly in azimuth plane. Calculate the maximum line of sight (LOS) range and strength of the received signal at 16 m high receiving antenna at a distance of 10 km. At what distance would be signal strength reduce to 1 mV/m.

OR

11 (a) Discuss about the structural details of the region above the earth surface up to ionosphere.
(b) The maximum distance between the transmitting and receiving antenna of TV towers is 72 km. If the ratio of height of transmitting and receiving antennae is 16:25, what are the heights of towers? Assume that the radius of the earth is about 6.371×10^6 km.

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