R13

Code No: 115DQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech III Year I Semester Examinations, February/March - 2016

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

Part- A

(25 Marks)

1.a) Define beam efficiency. [2]

b) An elliptically polarized wave traveling in the positive z direction in air has x and y components:
$Ex = 3 \sin(\omega t - \beta x)$ $(V\ m^{-1})$
$Ey = 3 \sin(\omega t - \beta x + 75°)$ $(V\ m^{-1})$
Find the average power per unit area conveyed by the wave. [3]

c) Explain important features of a loop antenna. [2]

d) Why are wide band antennas required? Name any two wide band antennas. [3]

e) What are the limitations of microstrip antenna? [2]

f) List different types of reflectors. [3]

g) Define different types of array of antennas. [2]

h) What is Huygen's principle? [3]

i) Write the expression for relation between MUF and skip distance. [2]

j) Obtain the roughness factor at 3MHz for an earth having $\sigma = 0.5$, with $\theta = 30°$. Calculate the ratio of roughness factors for the same earth and same θ if frequency is doubled. [3]

Part-B

(50 Marks)

2.a) Show that the Radiation resistance of $\lambda/2$ antenna is 73Ω.

b) Obtain the relative amplitudes of radiation, induction and electro static fields at a distance of 2λ from a short current element having an uniform current of 1mA along its length. [5+5]

OR

3.a) Explain radiation resistance of loops.

b) A plane wave is incident on a short dipole, assume the wave is linearly polarized with E in the y direction. The current on the dipole is assumed constant and in the same phase over its entire length, and the terminating resistance R_T is assumed equal to the dipole radiation resistance R_r. the antenna loss resistance R_L is assumed equal to zero. What is (i) the dipoles's maximum effective aperture and (ii) its directivity? [5+5]

4.a) With neat illustrations, explain the geometry and requirements for a helical antenna radiating into axial mode, and give the relevant design relations.

b) Describe the requirements, performance characteristics and applications of Yagi-Uda Antenna. [5+5]

OR

5.a) Explain the design considerations of Pyramidal Horns.

b) What is folded dipole? List its characteristics and its applications. [5+5]

6.a) Explain about non metallic dielectric lens antenna.

b) Estimate the curvature profile for a parabolic reflector antenna, and hence define the terms: Aperture Blocking, Focal Length to Diameter Ratio. [5+5]

OR

7.a) Explain in detail about corner reflector design.

b) Calculate and plot the radiation pattern of $\lambda/2$ dipole antenna spaced 0.15 λ from an infinite flat sheet for assumed antenna loss resistance $R_L = 0\ \Omega$ and 5Ω. Express the patterns in gain over a $\lambda/2$ dipole antenna in free space with the same power input. Assume zero loss resistance. [5+5]

8.a) Use the principle of pattern multiplication and draw the radiation pattern with 8 element array with $d = \lambda/2$.

b) Explain typical sources of error in antenna measurement. [5+5]

OR

9.a) With a neat block diagram, explain the method of measurement of radiation pattern of an antenna.

b) For a 16 element Broadside array with $\lambda/2$ spacing, derive the array factor and hence calculate its BWFN, first side lobe level, directivity and effective area. [5+5]

10.a) Explain the salient features of tropospheric scatter propagation.

b) Derive an expression for the variation of field strength of a space wave with antenna heights and distance involved. What happens when the distance is large? [5+5]

OR

11.a) With neat illustrations, explain the structure and formation of ionospheric layers, and the corresponding frequencies of propagation.

b) Explain the concept of reduction factor and numerical distance in ground wave propagation. [5+5]

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