Code No: 115DQ **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, July/August - 2023

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communication Engineering)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) Calculate effective length of $\lambda/2$ antenna. Given $R_r = 73\Omega$, $Ae = 0.13\lambda^2$, $\eta=120\pi$. [2]
b) Define the terms antenna efficiency and radiation efficiency. [3]
c) Differentiate axial mode and normal modes in helical antenna. [2]
d) Calculate the aperture area of an optimum rectangular horn antenna operating at frequency of 6 GHz giving a gain of 20dBi. [3]
e) List out various methods available for analysis of microstrip antenna. [2]
f) Recall the operation of corner reflector antenna with design considerations. [3]
g) Enumerate the sources of error in antenna measurements. [2]
h) Write the advantages and disadvantages of binomial array. [3]
i) Recall the mechanism of radio wave bending by ionosphere. [2]
j) What is multi-hop propagation? Write its significance. [3]

PART - B

(50 Marks)

2.a) Define directivity, gain and polarization. Explain in detail different types of polarization.
b) A thin dipole antenna is $\lambda/15$ long. If the loss resistance is 1.5Ω, find the radiation resistance and efficiency. [5+5]

OR

3.a) Prove that $D=4\pi/\Omega_A$, where Ω_A is the beam solid angle.
b) Prove the reciprocity theorem as applicable to antennas and hence show the equality of directional pattern for transmission and reception by same antenna. [5+5]

4.a) What is electromagnetic horn antenna? What are their practical applications?
b) Design Yagi Uda antenna to operate at 300 MHz. [4+6]

OR

5.a) Explain the significance of Helical antennas.
b) Enumerate the types of horn antennas. Explain how each horn antenna is obtained from a wave guide transition. [3+7]

6.a) Design a rectangular microstrip antenna using RT Duroid substrate with dielectric constant of 2.2, h = 0.15cm so as to radiate at 10GHz.

b) Draw the radiation patterns of square corner reflector antenna with spacing d=0.5λ, d= λ, d = 1.5λ. [5+5]

OR

7.a) Show that the contour of a nonmetallic dielectric lens antenna is a hyperbola.

b) Differentiate Delay lens and fast lens. Also explain the functionality of each in detail. [5+5]

8.a) Explain gain measurement of antenna using three antenna method.

b) For a non-uniform broadside linear array derive the expression for array factor if the array has (i) even number of elements and (ii) odd number of elements. [4+6]

OR

9.a) With a neat sketch of measurement set up explain the procedure for antenna radiation pattern measurement.

b) Show that SLL is -13.5dB below main lobe level in an N element uniform linear array. [5+5]

10.a) Explain the phenomenon of ground wave propagation and show how it is affected by the terrain and earth curvature.

b) Derive the expression for skip distance. [5+5]

OR

11.a) Communication is to be established between two stations 1500 Km apart. Calculate maximum usable frequency you may choose for communication using ionosphere as reflector if the height and plasma frequency of ionosphere at the point of reflection are 250 km and 12 MHz respectively. Assume thin ionosphere and flat earth.

b) Define the terms critical angle, maximum usable frequency, lowest usable frequency, critical frequency, skip zone and skip distance. [5+5]

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