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Code No: 156AF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, March - 2024

ANTENNAS AND 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) Write the expressions to calculate directivity of linearly polarized antenna and circularly polarized antenna. [2]
b) State any two antenna theorems. [3]
c) Write the conditions for obtaining broadside array and end fire array. [2]
d) Enumerate the five degrees of freedom available with array antennas. [3]
e) Write the design equations of 3 element yagi uda antenna. [2]
f) Enumerate the types of horn antennas. Explain how each horn antenna is obtained from wave guide transition. [3]
g) What is the role of substrate parameters in the design of microstrip antenna? [2]
h) Explain the importance of f/D ratio in the design of parabolic reflector antenna. [3]
i) Define skip distance. [2]
j) Explain the effect of earths curvature on wave propagation. [3]

PART – B

(50 Marks)

2.a) Derive the expressions for electric and magnetic field components of small loop antenna.
b) Prove that $D=4\pi/\Omega_A$, where Ω_A is the beam solid angle. [5+5]

OR

3.a) List the field equations of half wavelength dipole antenna. Calculate the power radiated by half wavelength dipole antenna using these fields. Further, calculate its radiation resistance.
b) A thin dipole antenna is $\lambda/10$ long. If the loss resistance is 2 Ω find the radiation resistance and efficiency. [6+4]

4.a) 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.
b) Explain the principle of pattern multiplication with three examples. [6+4]

OR

5.a) Explain the techniques used to measure the radiation pattern of the antenna.
b) With a neat block diagram, explain the antenna gain measurement using absolute gain method. [5+5]

6.a) Design a 10-turn helix to operate in the axial mode. For an optimum design, determine
i) Circumference (in λo), pitch angle (in degrees), and separation between turns (in λo)
ii) Relative (to free space) wave velocity along the wire of the helix for end-fire design.

b) Explain the construction and working of Yagi Uda Antenna. [5+5]

OR

7.a) Compared to dipole antenna explain the two methods by which the input impedance of folded dipole antenna can be increased.

b) List the advantages, disadvantages and applications of helical antenna. [5+5]

8.a) Explain the principle of parabolic reflector antenna in transmit and receive mode of operations. Enumerate its feeding mechanisms and explain the significance of each of them.

b) Explain the operation of corner reflector antenna with design considerations. [5+5]

OR

9.a) Evaluate the radiation mechanism in microstrip antenna using transmission line model analysis.

b) Write the design equations used in the design of rectangular microstrip antenna. [5+5]

10.a) Explain the factors affecting the ground wave propagation.

b) Define maximum usable frequency and derive secant law. [5+5]

OR

11.a) Draw the structure of ionosphere. Write the characteristics and explain the significance of each layer.

b) Write a note on space wave propagation. [5+5]

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