M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

First Semester

M.E. - Communication Systems

24PCOPC101 - ADVANCED RADIATION SYSTEMS

Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K – Level	CO

1. The standard reference antenna for the directive gain is the — 1, K2, CO1
   (a) infinitesimal dipole   (b) isotropic antenna   (c) elementary doublet   (d) All of the above

2. The radiation resistance of a short dipole is — 1, K2, CO1
   (a) $80\pi^2 \left(\frac{dl}{\lambda}\right)^2$ (b) $10\pi^2 \left(\frac{dl}{\lambda}\right)^2$ (c) $40\pi^2 \left(\frac{dl}{\lambda}\right)^2$ (d) $20\pi^2 \left(\frac{dl}{\lambda}\right)^2$

3. For square corner reflector the flaring angle is……………………. — 1, K2, CO2
   (a) 30 degrees   (b) 45 degrees   (c) 60 degrees   (d) 90 degrees

4. The principle used in slot antennas is — 1, K1, CO2
   (a) Babinet's   (b) Doppler Effect
   (c) Pattern multiplication   (d) None of the above

5. If the progressive shift in antenna array is equal to zero then it is — 1, K2, CO3
   (a) Fishbone antenna   (b) Broad side array   (c) Yagi-uda array   (d) End-fire array

6. Condition of an ordinary end-fire array is — 1, K1, CO3
   (a) α < βd   (b) α > βd   (c) α = ±βd   (d) α ≠ ±βd

7. Size of MSA can be reduced by using — 1, K2, CO4
   (a) Substrate with higher relative permittivity
   (b) Shorting post at appropriate location
   (c) Cutting slot at appropriate location
   (d) Any combination of the above techniques

8. As 'h' increases, fringing fields and probe inductance _____ frequency decreases and input impedance plot shifts _____. — 1, K2, CO4
   (a) increases, shift upward   (b) increases, shift downward
   (c) decreases, shift upward   (d) decreases, shift downward

9. UWB systems are particularly well-suited for applications requiring: — 1, K2, CO5
   (a) Long-range Wide Area Networks (WAN)
   (b) High-accuracy indoor location tracking
   (c) High-power broadcasting
   (d) Systems with significant jitter requirements

10. The main purpose of an anechoic chamber in antenna measurements — 1, K1, CO6
    (a) To amplify the antenna's signal
    (b) To provide a controlled, non-reflective environment
    (c) To measure the antenna's internal resistance
    (d) To simulate different weather conditions

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. List the significance of impedance matching. — 2, K1, CO1

12. Find the R_{rad} of an infinitesimal dipole whose overall length is λ/50. — 2, K2, CO1

13. At 2.7GHz, the increase in antenna temperature from Cygnus A with a 20m dish antenna is 51k. Compute the aperture efficiency of the antenna. — 2, K2, CO2

14. State Huygen's principle. — 2, K1, CO2

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **14170**

15. Express the array factor for odd illumination and sketch the pattern.	2	K2 CO3
16. State the principle of Pattern Multiplication.	2	K1 CO3
17. Explain how the properties of the substrate material influence the performance of a microstrip antenna.	2	K2 CO4
18. List the different types of feeding mechanism in microstrip antenna.	2	K1 CO4
19. List the antenna configurations used in base stations.	2	K1 CO5
20. State the suitable location of antenna on a regular passenger car.	2	K2 CO5
21. Demonstrate the instruments required to accomplish an antenna measurement task.	2	K2 CO6
22. Draw the block diagram to measure the radiation pattern of an antenna.	2	K1 CO6

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23. a) The radiation intensity of an antenna is given by $U(\theta,\emptyset)=B_0 Sin\theta Sin^2\emptyset$, $0 \leq \theta \leq \pi$, $0 \leq \emptyset \leq \pi$, and 0 elsewhere. Determine the maximum directivity using numerical techniques. Compare it with the exact value. — 11 K2 CO1

OR

b) (i) Describe the numerical techniques and EM software used for the analysis of an antenna. — 3 K2 CO1

(ii) Outline the matching techniques used in broadband antennas. — 8 K2 CO1

24. a) (i) Classify the various types of horn antennas and explain how each type is used in practical radiation applications." — 5 K2 CO2

(ii) Describe the working of pyramidal horn antenna and derive the expression for directivity. — 6 K2 CO2

OR

b) Describe the various feed mechanism of a reflector antenna. Explain the methods used to eliminate aperture blockage. — 11 K2 CO2

25. a) Discuss the fundamental configuration of a phased array in detail, and explain how it is employed for tracking applications. — 11 K2 CO3

OR

b) Explain the design procedure for a broad side Dolph Tschebyscheff array of 2M or 2M + 1 elements with spacing 'd' between the elements. — 11 K2 CO3

26. a) Describe the design methodology for a microstrip antenna array and its feed network, incorporating appropriate diagrams and governing equations. — 11 K2 CO4

OR

b) Explain the operating principle of the rectangular patch antenna and derive the electromagnetic field expressions for a rectangular microstrip patch antenna using the transmission-line model. — 11 K2 CO4

27. a) Design a Yagi Uda antenna of six elements to provide a gain of 12 dB if the operating frequency is 200MHz. Draw a scaled diagram that marks element types (reflector, driven element, director), element lengths and diameters, center-to-center spacings, boom length and feed point location. Analyze the design consideration for spacing between the elements, mechanical mounting and wind load. — 11 K3 CO5

OR

b) Design log periodic antenna array to cover a frequency range of 84 to 200 MHz and to have a 7.5dB gain. Explain the antenna, compute the required element lengths and spacing for optimal working. Sketch the antenna and indicate the measurements. Analyze the performance of the antenna in terms of bandwidth and impedance matching requirement. *11* *K3* *CO5*

28. a) With necessary diagrams explain the anechoic chambers. Discuss in detail the absorbing materials used for Antenna measurements. *11* *K2* *CO6*

OR

b) Analyze the CATR reflector edge treatments to reduce the diffracted fields in the quiet zone. *11* *K2* *CO6*