Reg. No. : | | | | | | | |

Question Paper Code : 20101

M.E./M.Tech. DEGREE EXAMINATION, JANUARY 2011.

First Semester

Communication Systems

251101 — ADVANCED RADIATION SYSTEMS

(Regulation 2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the two important goals especially for antennas of small portable phones? Which planar antenna is preferable for mobile stations?

2. State the principle of Type III Balun.

3. Define FNBW and HPBW of aperture antenna.

4. Define and give the expression for Directivity of a Horn antenna.

5. What is known as phased array?

6. What is meant by binomial array?

7. Define Radiation conductance of Microstrip antennas.

8. State Babinet's principle and its use in Microstrip antenna design.

9. Clearly define near field and far field.

10. What is radiation efficiency of an antenna?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive expressions for the radiation intensity, input impedance and Directivity of an antenna. (10)

(ii) A resonant half-wave dipole is made up of Copper ($\sigma = 5.7 \times 10^7\ S/m$) Wire. Determine the conductance – dielectric (radiation) efficiency of the dipole antenna at f = 100.5 MHz if the radius of the wire is $2 \times 10^{-4}\ \lambda$ and the radiation resistance is 73 ohms. (6)

Or

(b) (i) Briefly explain the Loop antennas and derive expression for its radiated fields. (10)

(ii) Find the radiation efficiency of a single turn, and an 8-turn small circular loop at f = 100.5 MHz. The radius of the loop is $\lambda/25$, the radius of the wire is $10^{-4}\ \lambda$ and the turns are spaced $4 \times 10^{-4}\ \lambda$ apart. Assume the wire is copper with conductivity of $5.7 \times 10^7\ S/m$ and the antenna is radiating into free space. (6)

12. (a) (i) Describe rectangular apertures and derive expressions for its uniform distribution on an infinite ground plane and space. (10)

(ii) A rectangular aperture with a constant field distribution with a = 4λ and b = 3λ, is mounted on an infinite ground plance compute

(1) FNBW in E-plane.

(2) HPBW in E-plane.

(3) FSLBW in E-plane.

(4) FSLMM in E-plane and

(5) Directivity. (6)

Or

(b) (i) Describe the Pyramidal Horn and its Aperture fields, equivalent and radiated fields with their diagrams and expressions. (10)

(ii) A Pyramidal horn has dimensions of $\rho_1 = \rho_2 = 6\lambda$, $a_1 = 5.5\lambda$, $b_1 = 2.75\lambda$, $a = 0.5\lambda$ and $b = 0.25\lambda$. Check if such horn can be constructed physically. If yes, compute its Directivity. (6)

13. (a) Given the array of the figures (1) and (2), find the nulls of the total field when d = $\lambda/4$ and

(i) $\beta = 0$

(ii) $\beta = +\frac{\pi}{2}$ and

(iii) $\beta = -\frac{\pi}{2}$.

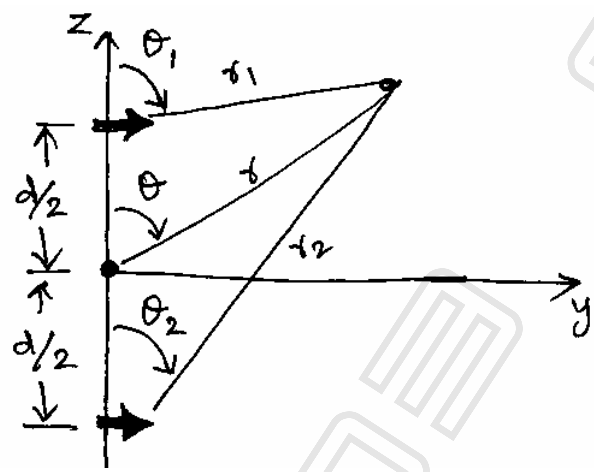

Figure (1)

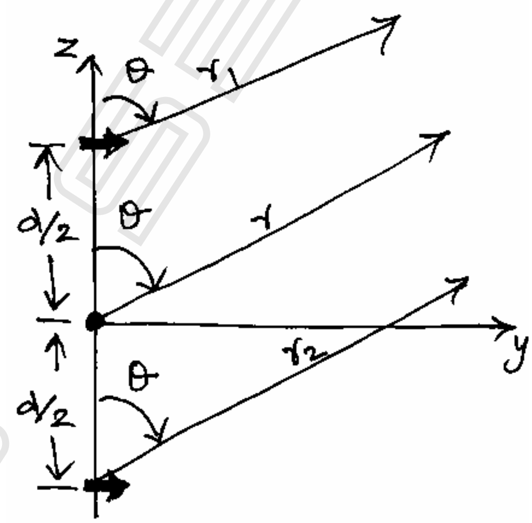

Figure (2)

Or

(b) Derive the expressions for Directivity of the following N-element Linear array antennas.

(i) Broadside array. (5)

(ii) Ordinary end-fire array. (5)

(iii) Phased array. (6)

14. (a) (i) Derive expressions for the radiated fields of a Microstrip antenna. (10)

(ii) Design a rectangular Microstrip antenna using a substrate with dielectric constant of 2.2, h = 0.1588 cm so as to resonate at 2.45 GHz. (6)

Or

(b) (i) Explain the design procedure involved in the Microstrip array and feed network design. (10)

(ii) Describe the applications of Microstrip array antenna. (6)

15. (a) (i) Describe the concept of EMC measuring antenna, and transmitting and receiving antenna factors. (10)

(ii) Explain the significance and applications of multi turn loop antenna. (6)

Or

(b) (i) Describe the compact Antenna Test Ranges and Near field ranges with neat diagrams. (10)

(ii) Draw and explain the anechoic chambers and Absorbing materials used for Antenna measurements. (6)

———————