Reg. No. :

Question Paper Code: U5404S

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2024

Fifth Semester

Electronics and Communication Engineering

21UEC504 - ANTENNA AND WAVE PROPAGATION

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

PART A - (5 x 1 = 5 Marks)

1. The directivity of the isotropic antenna is _____   CO1-U

    (a) 1   (b)0   (c) 2   (d) 3/2

2. A half-wave dipole used at a frequency of 300MHz has a length of _____   CO1-U

    (a) 10 m   (b) 3 m   (c) 15 m   (d) 12 m

3. Antenna that does not belong to the horn antenna family among the following   CO1-U
    are:

    (a) Pyramidal horn   (b) Conical horn   (c) bi-conical horn   (d) None of the above

4. Log periodic antenna is   CO1-U

    (a) frequency independent   (b) frequency dependent

    (c) both (a) & (b)   (d) None of the above

5. Microwave signals follow the curvature of earth and the phenomenon known is   CO1-U

    (a) Tropospheric scatter   (b) Duct propagation

    (c) Faraday Effect   (d) None of these

PART – B (5 x 3= 15 Marks)

6. A dipole antenna has a radiation resistance of 75 ohms and loss resistance of 20   CO1-U
    ohms. Determine its efficiency.

7. Distinguish between isotropic source and omni directional source.   CO1-U

8. Draw the geometry for E-plane type of metal-plate lens antenna.   CO1-U

9. What are the applications of Micro strip antenna?   CO1-U

10. Define virtual height.   CO1-U

PART – C (5 x 16= 80 Marks)

11. (a) Prove that the EMFs generated by an antenna are same when it is   CO1-U   (16)
        used either transmitting or receiving mode.

                                            Or

    (b) Derive the expression for relation between Effective aperture and   CO1-U   (16)
        Directivity.

12. (a) Analyze the fields radiated from a quarter wave dipole antenna   CO4-Ana   (16)
        using Maxwell's equation.

                                            Or

    (b) Analyze the fields radiated from a $\lambda/2$ dipole antenna using   CO4-Ana   (16)
        Maxwell's equation.

13. (a) (i) Design a Aperture antenna (pyramidal horn antenna) for which   CO2-App   (8+8)
        the mouth height h=10λ. It is fed by rectangular waveguide with
        TE$_{10}$
        (ii) Design an antenna for satellite signal reception for the various
        aperture numbers
         i) 0.25
         ii) 0.5
         iii) 0.6
        Diameter of the mouth is 10m.Calculate the position of the focal
        point with reference to the rector mouth in each case and analyze
        it.

                                            Or

    (b) (i) Design a pyramidal horn antenna for which the mouth height   CO2-App   (8+8)
        h=20 λ. It is fed by rectangular waveguide with TE$_{10}$
        (ii) Calculate the angular aperture for a paraboloid reflector
        antenna for which the aperture numbers are
         i) 0.5
         ii) 0.6
         iii) 0.75
        Diameter of the mouth is 10m.Calculate the position of the focal
        point with reference to the reflector mouth in each case and
        analyze it.

14. (a) Design a 8 element YagiUda array for 172 MHz..Also calculate   CO4-Ana   (16)
        the same for 245 MHz and infer the results.

                                            Or

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(b) Design a Yagi–Uda array antenna that has a directivity of 12 dB at 145 MHz. Also calculate the same for 273 MHz. Analyze the results and find which is best suitable for broadcasting applications.   CO4-Ana (16)

15. (a) (i) Calculate the critical frequency for reflection at vertical incidence if the maximum value of electron density is $1.24*10^6$ cm-3.   CO3-App (8+8)
(ii) Assume the reflection takes place at a height of 400 km and maximum density corresponds to 0.9 refractive index at 10 MHz what will be the range for which MUF is 10 MHz?

<center>Or</center>

(b) (i) A VHF communication is established with 35 w transmitter at 90 MHz find the distance upto which the LOS communication may be possible if the heights if Tx& Rx antennas are 40 m & 25 m also find Er, field strength at receiver end.   CO3-App (8+8)
(ii) Assume the reflection takes place at a height of 400 km and maximum density corresponds to 0.9 refractive index at 10 MHz what will be the range for which MUF is 10 MHz?

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