C   Reg. No. :

Question Paper Code: 95404

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2023

Fifth Semester

Electronics and Communication Engineering

21UEC504 - ANTENNA AND WAVE PROPAGATION

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. The beam width of the antenna pattern measured at half power points is   CO1-U
    called_____

    (a) Half power beam width   (b) Full null beam width

    (c) Beam width   (d) None of the above

2. In an electrically large loop, an overall length of the loop is equal to _____   CO1-U

    (a) $\lambda/2$ (b) λ (c) $\lambda/20$ (d) $\lambda/50$

3. In lens antenna, what kind of wave energy is transformed into plane
    waves?   CO2-U

    (a) Convergent   (b) Divergent   (c) Contingent   (d) Congruent

4. In Rhombic antenna maximum gain is along the   CO1-U

    (a) main axis   (b) minor axis   (c) back side of the hemisphere   (d) none of these

5. Relative Permittivity of the ionosphere at radio frequencies is   CO1-U

    (a) >1   (b) <1   (c) 1   (d) 0

PART – B (5 x 3= 15Marks)

6. Calculate the maximum effective aperture of an antenna which is operating at a   CO1- U
    wavelength of 2 metres and has directivity of 100.

7. What is the radiation resistance of a current element whose overall length is $\lambda/50$ CO1 -U

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

9. Define Parasitic elements.   CO1 -U

10. What are the factors that affect the propagation of radio waves?   CO1 -U

PART – C (5 x 16= 80Marks)

11. (a) (i) A transmitting antenna having effective height of 6.14 m takes   CO2 -App   (8)
a current of 50 amp, at a wavelength of 625 m. Find radiation
resistance and power radiated by an antenna.

(ii) In microwave communication link, two identical antennas   CO2 -App   (8)
operating at 10 GHz are used with power gain of 40 dB. If the
transmitter power is 1W, find the received power, if the range of
the link is 30 km.

Or

(b) (i) Calculate the gain of an antenna with a circular aperture of   CO2 -App   (8)
diameter 3m at a frequency of 5 GHZ.

(ii) Two spacecraft are separated by 100 mm. Each has an   CO2- App   (8)
antenna with D = 1000 operating at 2.5 GHz. If craft A's receiver
requires 20 dB over 1 pW, what transmitter power is required on
craft B to achieve this signal level?

12. (a) Derive the fields radiated from a half-wave dipole antenna. Also   CO1- U   (16)
find the power radiated from the same.

Or

(b) Obtain expression of (i) directions of pattern maxima (ii)   CO1- U   (16)
directions of pattern minima, for broadside array consisting of 2
point sources of equal amplitude and in phase. Plot the field
pattern.

13. (a) (i) A parabolic reflector antenna with diameter 20m is designed to   CO2-App   (8)
operate at a frequency of 6 GHz and illumination efficiency of
0.54. Calculate the antenna gain in decibels.

(ii) Estimate the diameter and the effective aperture of a   CO2-App   (8)
paraboloidal reflector antenna required to produce a null beam
width of 10° at 3 GHz.

Or

(b) (i) Design a Aperture antenna (pyramidal horn antenna) for which   CO2-App   (8)
the mouth height h=10 λ. It is fed by rectangular waveguide with
TE_{10}

(ii) Design an antenna for satellite signal reception for the various   CO2-App   (8)
aperture numbers (i) 25 (ii) 5 (iii) 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.

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14. (a) Explain in detail, when the helical antenna produces circular and nearly polarization.   CO1- U   (16)

<div align="center">Or</div>

(b) Explain the techniques used for antenna gain measurement in detail.   CO1- U   (16)

15. (a) Discuss the structure of atmosphere with various layers. Specify the factors affecting the radio wave propagation.   CO1-U   (16)

<div align="center">Or</div>

(b) Explain the principle of ionospheric propagation with a neat diagram.   CO1-U   (16)

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