C **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: 95404

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

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 called_____ CO1-U

   (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) λ/2 (b) λ (c) λ/20 (d) λ/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 effective area of a half wave dipole operating at 1 GHz? CO1- U

7. Differentiate broad side and End fire array. CO1 -U

8. Find the terminal impedance of a thin λ/2 slot antenna when the impedance of a thin λ/2 dipole antenna is 73+j42.5 ohms. CO1- U

9. Mention the safety precautions to be followed while designing RF antenna. 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) Derive the relationship between Directivity, Gain and Beam solid angle. CO1 -U (8)

(ii) Explain in detail about Effective Aperture of an antenna CO1 -U (8)

Or

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

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

Or

(b) Describe a broadside array and deduce expressions for directions of pattern maxima, pattern minima and HPBW and plot the radiation pattern. CO1 -U (16)

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

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

Or

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

(ii) Design an antenna for satellite signal reception for the various 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. CO2-App (8)

14. (a) Explain construction and working principle of Yagi-Uda antenna and its design. CO1- U (16)

Or

(b) Explain the techniques used for Anechoic chamber measurement. CO1- U (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)

(ii) Assume the reflection takes place at a height of 400km and maximum density corresponds to 0.9 refractive index at 10MHZ what will be the range for which MUF is 10 MHZ? (8)

Or

(b) (i) A HF radio link has to be established between two points at a distance of 2500km on earth's surface. Consider the ionosphere height to be 200km and fc =5MHz. Calculate MUF for the given path.. CO3-App (8)

(ii) The electron density of an atmospheric layer at night is about $2*10^{12}$ m^{-3} At a 150km height and the signal MUF is 1.5 times the critical frequency for a transmission distance of 700km. Compute the following Critical frequency, Relative dielectric constant,. Phase constant,. wave impedance, wave velocity , Group velocity , Incident angle (8)