

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) / S4 (PT) (S,FE) Examination May 2024 (2015 Scheme)

**Course Code: EC306****Course Name: ANTENNA & WAVE PROPAGATION**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer any two full questions, each carries 15 marks*

Marks

- 1 a) An antenna has radiation resistance of 54Ω ; a loss resistance of 6Ω , power gain of 16dB and is drawing a peak current of 10A. Determine the power radiated by the antenna, antenna efficiency and its directivity (in db). (9)
- b) With the help of neat diagram explain how radiation patterns are measured for an antenna. (6)
- 2 a) Derive the expression for electric and magnetic field components of a short dipole excited with constant current. (10)
- b) Draw a plot indicating radiation pattern of a directive antenna and mark the following i) Major lobe ii) Minor lobes iii) Back lobe iv) Half Power Beam Width v) First Null Beam Width. (5)
- 3 a) State and prove reciprocity theorem for antennas. List out the assumptions made for proving the theorem. (9)
- b) The expression for magnetic field due to a small current element 'dl' at a distance 'r' from it is given by $H_\phi = \frac{I_m dl \sin\theta}{4\pi} \left[\frac{-\omega \sin\omega t_1}{cr} + \frac{\omega \cos\omega t_1}{r^2} \right]$. Identify near field and far field components. Also calculate the distance at which both near and far field components becomes equal. (6)

PART B*Answer any two full questions, each carries 15 marks*

- 4 a) Two point sources of equal amplitude and phase are symmetrically separated with respect to origin at a distance $\lambda/2$ between them where λ is the wavelength. Derive an expression for the far field; find the maxima, minima and half power point directions. (8)
- b) Explain the principle of operation of rhombic antenna with help of a diagram and mention any one application. (7)

- 5 a) With the help of neat diagram explain the principle of operation of V antenna. Draw the radiation pattern of resonant and non-resonant V antennas. (9)
- b) Explain the principle of pattern multiplication with a suitable example (6)
- 6 a) Design an array of n isotropic sources of equal amplitude and spacing (broad side case). Find the directions of pattern maxima and minima for $n=4$ and spacing $= \lambda/2$. (10)
- b) Explain parabolic dish antenna. Draw its diagrams on transmitting and receiving mode. (5)

PART C

Answer any two full questions, each carries 20 marks

- 7 a) What is meant by space wave propagation? Derive the expressions for line of sight distance and field strength at a distance for space wave propagation. (15)
- b) With the help of a diagram explain the scaling factor of a log periodic antenna. (5)
- 8 a) Explain the construction and modes of operations of a helical antenna with the help of necessary diagrams and equations. Mention the type of polarization and any two applications of helical antenna. (15)
- b) Explain ground wave propagation? State any two disadvantages. (5)
- 9 a) Explain four major feeding techniques used in microstrip patch antennas with the help of diagrams. (10)
- b) Derive the expression for refractive index of ionosphere. (Neglect the effect of earth's magnetic field) (10)
