[4459] – 190

Seat No.	

T.E. (E & TC) (Semester – II) Examination, 2013
WAVE THEORY AND ANTENNAS
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answers to the **two** Sections should be written in **separate** answer-books.*
*2) Black figures to the **right** indicate **full** marks.*
*3) Use of Logarithmic tables, slide rule, electronic pocket calculators are **allowed**.*
*4) Assume suitable data, if **necessary**.*
*5) Answer **three** questions from **each** Section.*
*6) Neat diagrams must be drawn **wherever** necessary.*

SECTION – I

1. The magnetic field component of a plane wave in a lossless dielectric is $\overline{H} = 30\sin(2\pi\times10^{8}t - 5x)\hat{a}_z$ mA/m. **18**

   a) If $\mu_r = 1$, find ε_r.

   b) Calculate the wavelength and wave velocity.

   c) Determine the wave impedance.

   d) Determine the polarization of the wave.

   e) Find the corresponding electric field component.

   OR

2. Write the Maxwell equations in phasor form, derive the wave equation, solve the wave equation for Transverse Electromagnetic (TEM), and clearly mention the assumptions to be made. **18**

P.T.O.

3. Explain the following wave propagation techniques with relevant diagrams, mathematical expressions, advantages, disadvantages, specifications and their applications :
   i) Ground wave
   ii) Sky wave
   iii) Space wave **16**

OR

4. a) Explain the following terms with relevance to wave propagation with relevant mathematical expressions and diagrams. **8**
      i) Maximum Usable Frequency
      ii) Skip Distance
      iii) Virtual Height.

   b) A high frequency radio link has to be established between two points on the earth 2000 km away. If the reflection region of the Ionosphere is at height of 200 km, and has a critical frequency of 6MHz, calculate the MUF for the given path. **8**

5. a) Define the current distribution for small dipole, find Vector Magnetic Potential, Electric Field and Magnetic Field for far field region. **8**

   b) Define and explain the significance of the Retarded Vector Magnetic Potential and its applications in Antenna Analysis with relevant mathematical support. **8**

OR

6. Define the following terms with relevant mathematical expressions and diagrams **16**
   i) Radiation Resistance
   ii) Radiation Pattern
   iii) Isotropic
   iv) Omni Directional
   v) Far Field
   vi) Directivity
   vii) Gain
   viii) Polarization.

SECTION – II

7. a) Derive the expression for array factor N – element linear array considering the first element at reference. Explain the pattern multiplication with the help of derivation. **8**

   b) Draw the radiation pattern for 6 element linear Broadside array considering the inter element spacing to be half wave length. **8**

OR

8. a) Derive the expression for N-element array for odd and even number of elements considering the centre element as reference. **8**

   b) Design Dolph-Tschebyscheff's array by finding the coefficients for N = 8 and side lobe level to be below 40dB. **8**

9. With the help of Structural details, dimensions, radiation pattern, specifications, features and applications, explain the following antennas **18**

   i) V-Antenna

   ii) Rhombic antenna

   iii) Whip antenna

   iv) TW antennas.

OR

10. a) Determine the voltage induced in a frame aerial loop antenna that has 12 turns and is 1 m square. The incident wave 100 $\mu V/m$ field strength and of 10MHz frequency. The frame of the aerial is parallel to the direction of propagation of the waves. **6**

    b) Calculate the effective length of a ferrite rod receiving antenna which has 120 turns wound on a 1.40 cm diameter ferrite rod which has a relative permeability of 160. Assume the length factor to be 0.75 and the frequency to be 1MHz. **6**

    c) Calculate the radiation resistance of a single turn and an eight turn small circular loop when the radius of the loop is $\lambda/25$ and the medium is free space. **6**

11. With the help of Structural details, dimensions, radiation pattern, specifications, features and applications, explain the following antennas **16**

    i) Lens Antenna

    ii) Folded Dipole

    iii) Yagi Uda

    iv) Slot Antenna.

OR

12. a) Enlist the Structural details, dimensions, radiation pattern, specifications, features and applications of Microstrip Antenna and explain the design procedure. **8**

    b) Draw the structural diagram of parabolic reflector and explain the various feeding techniques for the same and the design specifications with the design procedure. **8**