[4658] – 90

Seat No.	

T.E. (E & TC) (Semester – II) Examination, 2014
WAVE THEORY AND ANTENNAS
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer **any three** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in separate books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Figures to the **right** indicate **full** marks.*
*5) Use of logarithmic tables, slide rule and electronic pocket calculator is **allowed**.*
*6) Assume suitable data, if **necessary**.*

SECTION – I

1. a) State Maxwell's field equations and explain their significance. Derive the wave equation for lossless dielectric medium. **8**

   b) A wave is propagating in a lossless dielectric has component, **8**

   $\overline{E} = 500\ \cos(10^7 t - \beta z)\overline{a}_x$ V/m and $\overline{H} = 1.1\ \cos(10^7 t - \beta z)\overline{a}_y$ A/m. If the wave is travelling at a velocity 0.5 times the velocity in free space, find;

   i) μ_r ii) ε_r iii) β

   iv) λ v) η

OR

2. a) State the significance of Poynting vector and derive the expression for Poynting vector P. **8**

   b) A uniform plane wave of frequency 5 MHz has average pointing vector 1.5 W/m^2. If the medium is lossless with relative permeability 2 and relative permittivity 3, Find : **8**

   a) Velocity of propagation
   b) Wavelength
   c) Intrinsic impedance of a medium and
   d) RMS value of electric field

3. a) Explain the following propagation modes with their operating frequency range **6**

   a) Ground wave
   b) Sky Wave

P.T.O.

b) A 150 meter antenna transmitting at 1.2 MHz by ground wave has an antenna current of 8 Ampere. What voltage is received by the receiving antenna 40 Km away, with a height of 2m ? **6**

c) Explain the effect of earth's magnetic field on the propagation of radio waves in ionosphere. **6**

OR

4. a) Explain the following in detail **(any two) :** **8**
   a) Maximum Utilization Frequency (MUF)
   b) Skip Distance
   c) Virtual Height

   b) Explain critical frequency. A radio link has to be established between two earth stations placed at a distance of 25000 Km between them. If the height of the ionosphere is 200 Km and critical frequency is 5 MHz. Calculate the MUF for given path. Also calculate electron density in the ionosphere layer. **10**

5. a) Define and explain the following radiation properties of antenna. **8**
   a) Radiation Pattern
   b) Radiation Intensity
   c) Radiation Density
   d) Effective Aperture

   b) Draw the flow diagram for E and H calculation with respect to current source J and H. Derive vector potential A for an electric current source J. **8**

OR

6. a) What is polarization ? Explain i) Elliptical polarization ii) Linear polarization iii) Circular polarization. **8**

   b) The radiation efficiency of a certain antenna is 95%. The radiation intensity is 0.5 W/Sr. Calculate the directivity of the antenna for following two case i) input power is 0.4 W and ii) radiated power is 0.3 W. **8**

SECTION – II

7. a) Describe the principle of broadside array and end fire array. **8**

   b) For an array of four isotropic sources along z-axis separated by a distance of $\lambda/2$ and a progressive phase shift $\alpha = 0$, find Null direction, Maxima direction, direction of side lobe maxima, HPBW and FNBW. **8**

OR

8. a) Define Array factor. Explain any one of the following : **8**
   1) Binomial array 2) Pattern Multiplication

   b) Explain with radiation characteristics N-element array with unequal magnitude and equal distance. **8**

9. a) Write short note **(any 2) :** **8**
   i) Travelling wave antenna
   ii) V antenna
   iii) Effect of ground and antenna height

   b) List the different antennas used at low frequencies ? Explain any one with its working, construction and application. **8**

OR

10. Explain in detail the working of the following antennas. **16**
    i) Ferrite rod antenna
    ii) Harmonic antenna
    iii) Rhombic antenna

11. Explain the following antennas with respect to construction, design, working principle and various applications with frequency range. **18**
    i) Yagi-Uda antenna
    ii) Folded dipole antenna
    iii) Horn antenna

OR

12. Write a note on the following antennas with reference to structural design, working, advantages, disadvantages and applications. **18**
    i) Microstrip antenna
    ii) Parabolic reflector antenna
    iii) Helical antenna.

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