CS/B.TECH/ECE/EVEN/SEM-6/EC-604A/2015-16

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Paper Code : EC-604A

ANTENNA THEORY AND PROPAGATION

Time Allotted : 3 Hours   *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The maximum distance which can be covered by ground wave for a given frequency is defined as

   a) $d_{max} = \dfrac{100}{\sqrt[3]{f(kHz)}} km$ b) $d_{max} = \dfrac{100}{\sqrt[3]{f(MHz)}} km$

   c) $d_{max} = \dfrac{100}{\sqrt{f(kHz)}} km$ d) $d_{max} = \dfrac{100}{\sqrt{f(MHz)}} km$.

ii) Critical frequency of the ionospheric layer is given as

   a) $f_c = 9\sqrt{N_{max}}$ b) $f_c = 81\sqrt{N_{max}}$

   c) $f_c = 9N_{max}$ d) $f_c = 81N_{max}$.

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iii) The correct expression for refractive index for any ionospheric layer is

   a) $n = \sqrt{\left[1 - \dfrac{81N}{f^2}\right]}$ b) $n = \sqrt{\left[1 - \dfrac{9N}{f^2}\right]}$

   c) $n = \sqrt{\left[1 - \dfrac{81N^2}{f^2}\right]}$ d) $n = \sqrt{\left[1 - \dfrac{9N^2}{f^2}\right]}$.

iv) An antenna acts as

   a)   Transducer

   b)   Trans-receiver for radio waves

   c)   Temperature sensing device

   d)   All of these.

v) Radiation resistance of an antenna depends upon

   a)   Operating wavelength

   b)   Operating frequency

   c)   Input power

   d)   None of these.

vi) Directivity of an antenna is

   a)   Proportional to antenna beam area

   b)   Inversely proportional to antenna beam area

   c)   Proportional to the half power beam widths in the principal planes

   d)   None of these.

vii) The radiation pattern of Yagi-Uda antenna is

   a)   Unidirectional

   b)   Multidirectional

   c)   Bidirectional

   d)   All of these.

viii) A small loop antenna is equivalent to a

a) Magnetic dipole   b) Short dipole

c) Short ring   d) Short coil.

ix) The example of parasitic array is

a) Helix antenna   b) Dipole antenna

c) Horn antenna   d) Yagi-Uda antenna.

x) When two point sources separated at the distance of half wavelength and fed with uniform currents in same phase, the array acts as a

a) End-fire array   b) Broadside array

c) Collinear array   d) Parasitic array.

xi) The vector wave equation is defined as

a) $\nabla^2 H = \gamma^2 H$ b) $\nabla^2 E = \gamma^3 E$

c) $\nabla^2 E = \gamma E$ d) $\nabla^2 H = \gamma H$.

xii) The highest electron density is found in

a) D-layer   b) E-layer

c) F1-layer   d) F2-layer.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define the Antenna. How does a monopole antenna radiate ?   2 + 3

3. Differentiate between broadside and end-fire array.

4. Define directive gain and polarization of an antenna. Write the Maxwell's equations.   (2 + 2) + 1

5. Find the radiation pattern of an antenna array of two point sources with same magnitude and phase of applied current. The point sources are spaced by half wavelength.

6. Prove that refractive index of ionosphere.

$$\mu = \sqrt{1 - \frac{81N}{f^2}}.$$

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. Discuss the normal and axial mode of operation of helical antenna. What are the important parameters for designing a rectangular horn antenna ? Discuss with proper diagram.   8 + 7

8. What is Duct Propogation ? Determine the Skip distance in sky wave propagation. What is radio horizon ? Define virtual height. What is maximum usable frequency ?   3 + 5 + 2 + 2 + 3

9. Write advantages and limitations of microstrip patch antenna. Design a rectangular microstrip antenna using a substrate with dielectric constant of 2·2 and thickness of 0·1588 cm, so as to resonate at 10 GHz.   5 + 10

10. Write the inconsistency of Ampere's law and the modification by Maxwell. Find out the electric and magnetic fields from a short magnetic dipole.   5 + 10

11. Write short notes any *three* of the following : 3×5

a) Yagi-Uda Antenna

b) Log periodic dipole array antenna

c) Antenna polarization

d) Space wave propagation

e) Feeding method of microstrip patch anenna.