Register Number: ……..

B.E DEGREE EXAMINATIONS: NOV/DEC 2010

Sixth Semester

ELECTRONICS AND COMMUNICATION ENGINNERING

U07EC603: Antennas and Wave Propagation

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. In a plane containing an isolated Hertzian dipole, the radiation pattern of the antenna is a

   A) Circle and the radiation pattern is circularly polarized

   B) Circle and the radiation pattern is linearly polarized

   C) Figure of eight and the radiation is circularly polarized

   D) Figure of eight and the radiation is linearly polarized

2. The radiation field and induction field are equal from the current element at a distance

   A) $\lambda/6$ B) $6/\lambda$ C) 6λ D) 3λ

3. For a half wave dipole the directivity D (in dB's) is obtained to be

   A) 2.151 B) 1.76 C) 3.14 D) 1.64

4. The radiation resistance of a single turn loop antenna is

   A) $320\pi^2\left(\frac{A}{\lambda^2}\right)^2$ B) $320\pi^4\left(\frac{A}{\lambda^2}\right)^2$ C) $197\left(\frac{C}{\lambda^2}\right)^2$ D) $197\left(\frac{C}{\lambda}\right)^2$

5. In a Rhombic antenna the angle of elevation of the main beam is controlled mainly by:

   A) Height of the antenna above the ground B) Tilt angle

   C) Length of the side wires forming the rhombic D) Terminating resistance

6. The antenna suited for wideband operation is

   A) Yagi-Uda antenna B) Rhombic antenna C) Log-Periodic antenna D) Folded dipole

7. Beam widths for corner reflectors are approximately equal in both principal planes, provided θ=:

   A) 120° B) 90° C) 60° D) 45°

8. Patch is a:

   A) High gain wideband antenna B) High gain narrowband antenna

   C) Low gain wideband antenna D) Low gain narrowband antenna

9. Skip Distance

   A) increases with decrease of frequency B) independent of frequency

   C) decreases with increase of frequency D) increases with increase of frequency

10. The critical frequency of an ionospheric layer is the

A) least frequency reflected by the layer

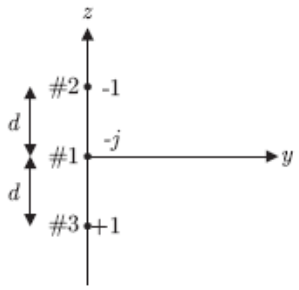
B) least frequency that is completely absorbed by the layer

C) highest frequency reflected by the layer for normal (vertical) incidence

D) highest frequency absorbed by the layer for normal (vertical) incidence

PART B (10 x 2 = 20 Marks)

11. What is antenna top loading?
12. Find the far-field distance for an antenna with maximum dimension of 1 m and operating frequency of 900 MHz.
13. A hypothetical isotropic antenna is radiating in free space. At a distance of 100 m from the antenna, the total electric field (E_θ) is measured to be 5 V/m. Find the power density and determine the power radiated.
14. A three-element array of isotropic sources has the phase and magnitude relationships shown in the figure below.



The spacing between the elements is d = λ /2. Find the array factor

15. Draw the structure of a 3 element Yagi-uda antenna and give the dimensions and spacing between the elements in terms of wavelength.
16. What are the two forms of long wire antenna and how will be the radiation pattern for the two forms?
17. What are the methods of feeding slot antenna with coaxial cable?
18. What is a square corner reflector?
19. Find the maximum range of a tropospheric transmission for which the transmitting antenna height is 100ft and receiving antenna height is 50ft.
20. How does the attenuation factor vary with numerical distance in Ground wave propagation?

PART C (5 x 14 = 70 Marks)

21. a) Derive the expression for far field patterns of infinitesimal dipole antenna and show that $E_\theta / H_\phi = \eta$.

(OR)

b) (i) Derive the radiation resistance of a Half wave dipole antenna (7)

(ii) A half-wave dipole is radiating into free space. The coordinate system is defined so that the origin is at the center of the dipole and the z axis is aligned with the dipole. Assuming an overall efficiency of 50%, find the power density in W/m^2 at r =500m, $\theta = 60^\circ and\ \phi = 0^\circ$. Input power to the dipole is 100W. (7)

22. a) (i) Explain with neat diagram the structure of Helical antenna and its different operating modes. (7)

(ii) The normalized radiation intensity of a given antenna is given by $U = \sin\theta \sin\phi$. The intensity exists only in $0° \le \theta \le 180°$, $0° \le \phi \le 180°$ and is zero elsewhere. Find the exact directivity, the azimuthal and elevation plane HPBW (in degrees) and the directivity from HPBW. (7)

(OR)

b) Derive an expression for array factor of n element broadside array. Also draw the pattern for different values of n of the array factor and spacing.

23. a) With neat diagram explain the working of Rhombic antenna and also derive the design equations for the rhombic antenna.

(OR)

b) Explain the construction and analysis of Log-Periodic antenna and give the design.

24. a) Derive the radiated fields and the characteristic impedance of Biconical antenna.

(OR)

b) (i) Derive the relation between aperture number and angular aperture for a parabolic reflector antenna. (7)

(ii) A rectangular microstrip patch with dimensions W and L over a single substrate, whose center frequency is 10 GHz. The dielectric constant of the substrate is ε_r=10.2and the height of the substrate is h=0.127cm. Determine the physical dimensions W and L of the patch taking into account field fringing. (7)

25. a) Derive the expression for Line of Sight distance between the transmitter and receiver in space wave propagation by considering the effective Earth's radius.

(OR)

b) Explain MUF and the different methods of calculating MUF.

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