Register Number: ……..

B.E., DEGREE EXAMINATIONS: MAY/JUNE 2013

Sixth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE 115 : Antennas and Wave Propagation

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The Directivity of a half wave dipole antenna is ---------
   a) 1.69 b) 1.63
   c) 1.5 d) 1.13
2. The phase difference between adjacent elements in an endfire array is---------
   a) 0° b) 180°
   c) 270° d) 90°
3. ---------- components are present in the fresnel region of Half wave dipole.
   a) E_r ,E_θ, H_ϕ b) E_r ,E_ϕ,H_θ
   c) E_θ, H_ϕ d) E_ϕ, H_θ
4. The radiation resistance of a short dipole whose length is $\lambda/10$ is,
   a) 8.89 Ω b) 7.89 Ω
   c) 18.89 Ω d) 17.89Ω
5. ----------antenna is not suitable for high frequencies.
   a) Yagi b) Loop
   c) Log-periodic d) Rhombic
6. The length of dipoles in the inactive region of log- periodic antenna is ----------
   a) less than λ b) less than $\lambda/2$
   c) greater than $\lambda/2$ d) greater than λ
7. Lengthening of a $\lambda/2$ antenna makes it more----------
   a) Resistive b) Capacitive
   c) Inductive d) no change
8. The Rhombic antenna produces----------polarized waves.
   a) Circularly b) Horizontally
   c) Vertically d) Elliptically

9. The Critical frequency of E layer is ----------

a) 1 KHz b) 5 KHz

c) 5 MHz d) 7 MHz

10. A 12 MHz radio wave will choose ----------propagation to reach the destination.

a) Ground wave b) Space wave

c) Sky wave d) Duct

PART B (10 x 2 = 20 Marks)

11. Define Radiation intensity. What is its unit?
12. Calculate the maximum effective aperture area of antenna which is operating at a wavelength of 2 meters and has a directivity of 100.
13. What do you understand by retarded current?
14. Compare electric scalar potential and magnetic vector potential.
15. What is a parasitic element? How does it act when length is greater than and smaller than $\lambda/2$?
16. What are the different modes of operation that can be used in Helical antenna? Compare them.
17. Mention the advantages and uses of lens antenna.
18. Estimate the diameter and the effective aperture of a paraboloidal reflector antenna required to produce a null beamwidth of 10° at 3 GHz.
19. What is meant by diversity reception? Mention the types.
20. Find the critical frequency of an ionized layer if the maximum value of electron density is $1.24 \times 10^6 \text{ cm}^{-3}$.

PART C (5 x 14 = 70 Marks)

21. a) (i) Define Effective aperture. Derive the relationship between directivity, gain and effective aperture. (7)

(ii) State and prove Reciprocity principle with regard to antennas**.** (7)

(OR)

b) Derive the expression for the far field pattern of an array of 2 – isotropic point sources fed with the current of

i) Equal amplitude and phase

ii) Equal amplitude and opposite phase

22. a) Derive the fields radiated from a half wave dipole antenna? Also obtain the power radiated and radiation resistance.

(OR)

b) Derive the expression for the electric and magnetic fields due to a hertzian dipole at a distance point in free space.

23. a) Explain the construction, operation and design of a rhombic antenna? Also mention its advantages, disadvantages and applications.

(OR)

b) (i) Explain the geometry of a log periodic antenna? (7)

(ii) Explain the methods of measuring antenna radiation pattern. (7)

24. a) Derive the expressions for fields radiated from an elemental area of a plane wave.

(OR)

b) (i) Derive the relationship between dipole and slot impedances. (7)

(ii) Explain the methods of feeding parabolic reflectors. (7)

25. a) (i) Explain in detail about mechanism of refraction and derive an expression for the refractive index of the ionosphere in terms of the electron number density and frequency? (10)

(ii) Using refractive index, obtain the expression for critical frequency of the ionized layer**.** (4)

(OR)

b) (i) Explain in detail about space wave propagation. (7)

(ii) Discuss the effects of earth's magnetic field on ionosphere radio wave propagation (7)

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