

Register Number:

B.E. DEGREE EXAMINATIONS: APRIL/ MAY 2012

Sixth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE115: Antennas and Wave Propagation

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. The radiation resistance of a 3-wire folded dipole is -----
a) 292 Ω b) 557 Ω c) 657 Ω d) 73 Ω
2. The phase difference between adjacent elements in a broadside array is-----
a) 0° b) 180° c) 270° d) 90°
3. The physical height of half wave dipole at 60MHz is-----
a) 1.5 m b) 1.5cm c) 2.5m d) 2.5cm
4. Which one of the following is correct?
a) The Directivity of a half wave dipole antenna is 1.69.
b) The radiation resistance of short dipole is 73.14 ohms
c) Minor lobes represent the radiation in desired direction.
d) $B = \nabla \times A$
5. The Helical antenna produces circularly polarized waves when axial ratio = -----.
a) 0 b) 1 c) ∞ d) 10
6. The gain of the Yagi-Uda antenna can be increased by -----
a) adding more directors b) adding more reflectors c) Both a & b d) increasing spacing
7. The directivity of rectangular aperture antenna is-----.
a) 11.56 A/λ^2 b) 12.56 A/λ^2 c) 13.56 A/λ^2 d) 14.56 A/λ^2
8. A vertical slot 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. The range of space wave propagation is -----km.
a) $\sqrt{h_t} + \sqrt{h_r}$ b) $5.12 [\sqrt{h_t} + \sqrt{h_r}]$ c) $4.12 [\sqrt{h_t} + \sqrt{h_r}]$ d) $h_t + h_r$

PART B (10 x 2 = 20 Marks)

11. Define Radiation Pattern and mention its various parts.
12. Compare broadside array and end fire array.
13. Write down the expressions for magnetic vector potential using three current distributions.
14. An antenna has a radiation resistance of 72 Ohms, a loss resistance of 8 Ohms and a power gain of 12dB. Determine the antenna efficiency and its directivity.
15. For a 20 turn helical antenna operating at 3 GHz with circumference of 10 cm and spacing between the turns is 0.3λ , Calculate the directivity
16. Draw the structure of 3 element yagi-uda antenna. Mention the dimensions.
17. Define frequency independent antenna. Give one example.
18. What is a microstrip antenna? Mention its advantages.
19. What are the components present in space wave?
20. Define magneto ionic splitting.

PART C (5 x 14 = 70 Marks)

21. a) (i) Define Effective aperture. Obtain the general expression for the effective aperture of a dipole antenna. Using that expression, find the effective aperture and directivity of Hertzian dipole. (7)
- (ii) State and prove Reciprocity principle with regard to antennas. (7)

(OR)

- b) Derive the expressions for maxima direction, minima direction, and half power point directions of an array having 4 point sources fed with the current of equal amplitude and opposite phase? Plot the radiation pattern.

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

(OR)

- b) Obtain the expressions for the electric and magnetic field components present in the fraunhofer region of a hertzian dipole?

23. a) Derive the expressions for far field components of a small loop antenna. Also obtain its radiation resistance.

(OR)

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

24. a) Derive the expressions for fields radiated from an elemental area of a plane wave.
(Hugger's Source)

(OR)

b) (i) Describe the parabolic reflectors used at microwave frequencies? (7)

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

25.a) (i) Derive the expression for resultant field due to space wave. (7)

(ii) What is an ionosphere? Explain the various regions of ionosphere. (7)

(OR)

b) 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? Also obtain the expression for critical frequency of the ionized layer?
