Register Number: ……………………..

B.E DEGREE EXAMINATIONS: MAY 2014

(Regulation 2009)

Sixth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE115: Antennas and Wave Propagation

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The effective length of a $\lambda/2$ antenna whose $A_{e\,max} = 0.13\lambda^2$ is ----------meters

   a) $0.317\,\lambda$ b) $0.713\,\lambda$

   c) $0.417\,\lambda$ d) $0.45\,\lambda$

2. The directivity of a beam antenna having half power beam widths of 30° and 20° is ---------.

   a) 45   b) 29

   c) 39   d) 42

3. The induction field surrounding the dipole varies as -------------

   a) $1/r^2$ b) $1/r$

   c) $1/r^3$ d) None of these

4. Poisson's equation for magnetic field is --------------

   a) $\nabla^2 V = -\rho/\varepsilon$ b) $\nabla^2 A = -\rho/\varepsilon$

   c) $\nabla^2 A = -\mu J$ d) $\nabla^2 A = -\mu^2 J$

5. In helical antenna, the condition for pitch angle α to get circular polarization is _____

   a) $\tan^{-1}(C/\lambda)$ b) $\tan^{-1}(2C/\lambda)$

   c) $\tan^{-1}(C/2\lambda)$ d) $\tan^{-1}(2\lambda/C)$

6. The operating frequency of Microstrip antenna is ------------

   a) 100 KHz   b) Above 100 MHz

   c) Below 100 MHz   d) 500 KHz

7. The directivity of rectangular aperture antenna whose area is 2 m^2 is------------

   a) $35.12/\lambda^2$ b) $20.52/\lambda^2$

   c) $25.12/\lambda^2$ d) $12.56/\lambda^2$

8. The material used for manufacturing non-metallic dielectric lens antenna is ------------

   a) Aluminum   b) Polystyrene

   c) Copper   d) Iron

9. The ionizing agent present in F_2 layer is ----------------

   a) Nitrogen atoms   b) Oxygen atoms

   c) UV rays   d) Alpha rays

10. A 20 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 power gain and write down the relation between directive gain and power gain.

12. An antenna has a radiation resistance of 52 Ohms, a loss resistance of 10 Ohms and a power gain of 22dB. Determine the antenna efficiency and its directivity.

13. Calculate the bandwidth of a 25 cm long half wave dipole having Q of 30?

14. Write down the expression for magnetic vector Potential using three standard current distributions?

15. List out the applications of helical antenna and loop antenna?

16. Mention the types of V antenna. Compare them.

17. Draw the different horn antenna shapes.

18. Find the power gain in db of a paraboloidal reflector of open mouth aperture 20 λ.

19. Define Skip Distance. Write down the formula used to find skip distance.

20. Mention the factors that cause attenuation in ground wave.

PART C (5 x 14 = 70 Marks)

21. a) i)   Show that the radiation resistance of a folded dipole is $n^2 \times 73$ ohms, where n is the number of dipoles. Mention the advantages and applications of folded dipole.   7

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

(OR)

    b) i)   Sketch the radiation pattern of a four element array having identical radiators spaced $\lambda/2$ apart and carrying currents of uniform amplitude and same phase.   10

      ii) Explain the principle of pattern multiplication with one example.   4

22. a)   Derive the fields radiated from a half wave dipole antenna? Also obtain the power radiated and radiation resistance.   14

(OR)

b) i) Derive the expression for the electric fields due to a hertzian dipole at a distance point in free space.   8

ii) Show that the radiation resistance of a hertzian dipole is $80 \pi^2 L^2/\lambda^2$ Ohms.   6

23. a) i) Derive the fields radiated from a small loop antenna and find its radiation resistance.   8

ii) A 20 turn helical antenna has a circumference of λ and turn spacing of $\lambda/2$. Determine the HPBW, BWFN and axial ratio.   6

(OR)

b) i) With a suitable diagram explain the construction, principle of operation and design of a log- periodic antenna.   10

ii) With neat diagram, describe the method used for measuring the gain of an antenna   4

24. a) i) What is a slot antenna? Compare slot antenna and its complementary dipole antenna. Also derive the relationship between dipole and slot impedances?   10

ii) Find the terminal impedance of a thin $\lambda/2$ slot antenna when the impedance of a thin dipole antenna is $73 + j\ 42.5$ ohms.   4

(OR)

b) Derive the expressions for the fields radiated from biconical antenna? Also obtain it characteristic impedance.   14

25. a) i) Deduce the expressions for the effective dielectric constant and conductivity of the ionosphere?   8

ii) The observed critical frequencies of E and F layers at a particular time are 2.5 MHz and 8.4 MHz respectively. Calculate the maximum electron concentrations of the layers.   6

(OR)

b) i) What is Space Wave propagation? What are the various components of space wave? Compare space wave propagation with ground wave propagation.   7

ii) Derive the expression for the resultant field due to space wave.   7

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