28/5/13

B.E.(FULL-TIME) DEGREE END SEMESTER EXAMINATIONS, APRIL/ MAY 2013

ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH

SIXTH SEMESTER

48

EC 9354 – ANTENNAS AND WAVE PROPAGATION

(REGULATION 2008)

Time: 3 Hours Max.marks: 100

Answer ALL Questions

PART-A (10x2=20 Marks)

1. 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.
2. Determine the effective area of an antenna which has a gain of 40 dB at a frequency of 300MHz.
3. A paraboloid reflector antenna with diameter 20 meters is designed to operate at frequency of 6GHz and illumination efficiency of 0.54. Calculate the antenna gain in decibels.
4. List the features of slot antenna.
5. What is meant by tapering of antenna arrays? List out its advantages.
6. How is the radiation pattern of an array with non-isotropic radiators obtained?
7. List out the advantages of dielectric resonator antenna.
8. What is reciprocity theorem as applied to an antenna?
9. What is meant by duct propagation?
10. A television transmitter antenna has a height of 169 metres and the receiver antenna has a height of 16 metres. What is the maximum distance through which the TV signal could be received by space wave propagation?

PART-B (5x16=80 Marks)

11. (i) Derive the expressions for the Electric and Magnetic fields of a half wavelength dipole antenna. Prove that, the directivity of a half wavelength dipole antenna is 1.64. **(10)**

    (ii) A lossless resonant half wavelength dipole antenna, with input impedance of 73 ohms, is to be connected to a transmission line whose characteristics impedance is 50 ohms. Assume that the pattern of the antenna is given by $U = A_0 \sin^3 \theta$. Determine the overall maximum gain of this antenna. **(6)**

12. a. (i) With neat diagram, explain the various types of horn antenna. Determine the length L, width W and Half flare angles of a pyramidal horn antenna for which the mouth height h=10λ. The horn is fed by a rectangular waveguide with TE_{10} mode. **(10)**

(ii) Explain the radiation mechanisms of a micro strip antenna. Mention its limitations and suggest the techniques to overcome the limitations. **(6)**

(Or)

12. b. Explain the principle of operation of parabolic reflector. With neat diagram, describe its feeding techniques and effects on various f/D ratio.

13. a. Derive the expressions for the radiation pattern of an end fire array with 4 equally spaced (element spacing = λ/2) isotropic antenna. Determine the HPBW and BWFN and plot the field pattern.

(Or)

13. b. Design a four element broadside array which has the optimum pattern for a side lobe level of -19.1 dB. The spacing between the elements has to be λ/2.

14. a. (i) With a suitable diagram and design equations, explain the construction and principles of operation of log periodic antenna. **(10)**

(ii) Describe the various impedance measurement methods. **(6)**

(Or)

14. b. (i) Explain the principle of operations of various modes of Helical antenna and enumerate the design equations of Helical antenna. **(10)**

(ii) A 10 turn helix is constructed at 8GHz with a circumference of 3.45cm and a pitch angle of 15°. Determine the HPBW and directivity. **(6)**

15. a. (i) With neat diagram, describe the structure of atmosphere. **(10)**

(ii) Derive the expression for the received electric field of the space wave propagation at a distance point, assuming a flat earth. **(6)**

(Or)

15. b. (i) Derive an expression for the refractive index of an ionosphere. Explain the mechanism of radio waves bending by the ionosphere. **(8)**

(ii) Derive and show how skip distance is related to the Maximum Usable frequency for the both flat and curved earth. **(8)**