# K 1108

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Seventh Semester

Electronics and Communication Engineering

EC 431 — ANTENNAS AND PROPAGATION

Time : Three hours                                      Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.  Write the three field zones with their boundaries of an antenna under test.

2.  What is meant by a resonant antenna?

3.  Define (a) Field pattern (b) Power pattern.

4.  State the features of radiation pattern multiplication principle.

5.  Calculate the physical height of a half wave dipole having antenna Q of 30 and bandwidth of 10 MHz.

6.  For a 20 turn helical antenna operating at 3 GHz with circumference $C = 10$ cm and the spacing between the turns $0.3\ \lambda$, calculate the directivity and half-power beam width.

7.  Draw the log periodic dipole antenna structures at UHF and VHF ranges.

8.  What are sectoral horn antennas?

9.  What are the factors that affect the propagation of radio waves?

10. A VHF communication link is to be established with 35 W transmitter at 90 MHz. Find the distance up to which the line of sight communication may be possible if the heights of the transmitting and receiving antennas are 40, 25 meters respectively.

PART B — (5 × 16 = 80 marks)

11. (i) Differentiate Broadside array from End fire array. (6)

    (ii) With neat sketches explain the principle of multiplication of radiation patterns. (10)

12. (a) (i) Derive FRIIS transmission formula. (6)

    (ii) A dipole having a length 3 cm is operated at 1 GHz. The efficiency factor $K = 0.6$. Calculate the radiation resistance, the antenna gain and the effective aperture. (6)

    (iii) Consider two similar dipoles having length 3 cm used as transmitting and receiving antennas. Find the power received by the receiving antenna if it is placed at a distance of 10 m from the transmitting antenna, which is radiating 15 W average power at $f = 1$ GHz. (4)

Or

    (b) (i) Define effective aperture. Derive an expression for maximum effective aperture for a pyramidal horn antenna used as receiving antenna, in terms of poynting vector. (8)

    (ii) Distinguish Radian from Steradian. (4)

    (iii) Compute the directivity of a half wave dipole antenna. (4)

13. (a) (i) Explain the development of half wave dipole radiator from an open circuited transmission line with neat sketches. (6)

    (ii) Draw a neat sketch of Helical antenna. Describe its principle of operation. (6)

    (iii) Write a technical note on 'Small loop antenna'. (4)

Or

    (b) Define radiation resistance. Derive an expression for radiation resistance of an Oscillating electric dipole. (3 + 13)

14. (a) (i) What are parasitic arrays? Explain. Draw a neat sketch of a 3-element YAGI-UDA array and explain its principle of operation. (3 + 5)

    (ii) Explain the basic principle of operation of a phase steered array antenna. (4)

    (iii) Write short notes on 'Advantages and potential applications of Microstrip antennas'. (4)

Or

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(b) (i) Describe in detail the different methods of feeding a parabolic reflector. (6)

(ii) Draw a neat block diagram for antenna radiation pattern measurement. Explain the procedure in detail. (10)

15. (a) (i) Draw the electron density profile chart of an ionosphere and explain. (6)

(ii) Derive an expression for effective relative dielectric constant of the ionosphere. (10)

Or

(b) (i) What is Faraday rotation in sky wave propagation? Explain. (9)

(ii) At a 150 km height in the ionosphere the electron density at night is about $2 \times 10^{12}$ m$^{-3}$ and the signal maximum usable frequency (MUF) is 1.5 times the critical frequency for a transmission distance of 600 km. Compute the following :

(1) Critical frequency

(2) Relative dielectric constant

(3) Phase constant

(4) Wave impedance

(5) Wave velocity

(6) Group velocity

(7) Incident angle. (7)