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Question Paper Code: 56402

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Sixth Semester

Electronics and Communication Engineering

15UEC602–ANTENNA AND WAVE PROPAGATION

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. The line – of – sight communication requires the transmit and receive   CO1- R
   antennas to face each other. If the transmit antenna is vertically polarized
   for best reception the receiver antenna should be _____ polarized.

   (a) Vertically

   (b) Horizontally

   (c) At 45 degree inclined with either horizontally or vertically

   (d) None of above

2. The radiation resistance of a circular loop of one turn is 0.01Ω. The   CO2- R
   radiation resistance of five turns of such a loop will be

   (a) 0.002Ω (b) 0.05Ω (c) 0.01Ω (d) 0.25Ω

3. Which conversion mechanism is performed by parabolic reflector antenna?   CO3- R

   (a) Spherical to plane   (b) Spherical to Polar   (c) Plane to Polar   (d) None

4. How do the elements of an active region behave in log periodic   CO4- R
   antenna

   (a) Capacitive   (b) Inductive   (c) Resistive   (d) Reflective

5. F_2 layer of appleton region acts as a significant reflecting medium for   CO5- R
   _____ frequency radio waves.

   (a) Low   (b) Moderate   (c) High   (d) All Frequency

PART – B (5 x 3= 15 Marks)

6. Define effective aperture of the antenna and relate the gain with effective aperture. CO1- U

7. Calculate the efficiency of a dipole with a radiation resistance of 68Ω and a total feed point resistance of 75 Ω. CO2- App

8. State field equivalence principle and list the usage. CO3- U

9. Draw the structure of 3 element yagi uda antenna and give the dimensions and spacing between elements in terms of wavelength. CO4- R

10. Define critical frequency, Find the critical frequency of an ionosphere layer which has an electron density of 1.24×10^6 cm^{-3}. CO5- App

PART – C (5 x 16= 80Marks)

11. (a) (i) Two antennas each with a gain of 1.64 are horizontally separated by a distance of 100 km to and from transmitter-receiver link. The transmitter feeds its antenna with 10W at 100MHz. Calculate the power received by the antenna. CO1- App (10)

(ii) The power radiated by a lossless antenna is 10 watts. The directional characteristics of the antenna are represented by the radiation intensity of $U=B_o \cos 3\theta$ (watts/unit solid angle) ($0 \leq \theta \leq \pi/2$, $0 \leq \varphi \leq 2\pi$) Find the
(a) Maximum power density (in watts/square meter) at a distance of 1,000 m (assume far-field distance). Specify the angle where this occurs.
(b) Exact and approximate beam solid angle ΩA CO1- App (6)

Or

(b) Write short notes on CO1- U (16)
(a) Half Power beam width,
(b) Polarization,
(c) Directivity,
(d) Principal patterns.

12. (a) From the Maxwell's equation derive the field expressions of the field quantities radiated from a λ/2 dipole and prove that the radiation resistance is 73Ω. CO2- App (16)

Or

2

56402

(b) (i) Derive the expression for the array factor of a linear array of 4   CO2- App   (10)
      isotropic element spaced $\lambda/2$ apart fed with signals of equal
      amplitude and phase. Obtain the directions of maxima and
      minima.

      (ii) Discuss the significance of binomial array   CO2- Ana   (6)

13. (a) Discuss the significance of F/D ratio and the geometry of a   CO3- U   (16)
          parabolic reflector along with its feed configurations.

                                    Or

     (b) (i) A pyramidal horn with aperture length of 10λ cm is fed by a   CO3- U   (10)
          rectangular waveguide in TE_{10} mode. Determine the design
          parameters of the antenna operating at 2.5GHz.

          (ii) Discuss in detail about radiation mechanism of slot antenna. CO3- U   (6)

14. (a) (i) Describe the modes of operation of helical antenna with design   CO4- U   (10)
          equations.

          (ii) Explain the procedure for the measurement of gain.   CO4- U   (6)

                                    Or

     (b) Design a log periodic antenna to cover all the VHF TV channels   CO4- App   (16)
          from 55 MHz to 220MHz. The required directivity is 9 dB and
          input impedance is 50Ω. The elements should be made of
          aluminum tubing with 2 cm outside diameters for the largest
          element and the feeder line and 0.48 cm for the smallest elements.
          These diameters yield identical (I/d) ratios for smallest and largest
          elements.

15. (a) (i) Draw the electron density profile chart of an ionosphere and   CO5- U   (10)
          explain the ionosphere propagation.

          (ii) Explain Troposcatter propagation.   CO5- U   (6)

                                    Or

56402

(b) Write short notes on   CO5- U   (8)

(i) Effect of earth magnetic field

(ii) Faraday's Rotation   CO5- U   (4)

(iii) Skip Distance   CO5- U   (4)