Total No. of printed pages = 3

ECE 181801

Roll No. of candidate

2023

B.Tech. 8th Semester End-Term Examination

Electronics and Telecommunication Engineering

ANTENNA AND WAVE PROPAGATION

New Regulation (w.e.f. 2017-2018) & New syllabus (w.e.f. 2018-2019)

Full Marks – Three   Time – 70 hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *Four* from the rest

1. Choose the correct answer from the following $(10 \times 1 = 10)$

    (i)   The velocity of electromagnetic radiation in a medium of permittivity ε_0 and permeability μ_0 is given by:

    (a) $\sqrt{(\mu_0 / \varepsilon_0)}$ (b) $\sqrt{(\varepsilon_0 / \mu_0)}$

    (c) $\sqrt{(\mu_0 \varepsilon_0)}$ (d) $1/\sqrt{(\mu_0 \varepsilon_0)}$

    (ii) The current distribution in a short dipole is

    (a) triangular   (b) sinusoidal

    (c) constant   (d) none

    (iii) Polarization is time varying behaviour of ———— at a point in space.

    (a) Magnetic field   (b) Electric field

    (c) Both (a) and (b)   (d) None of these

    (iv) The minimum value of the directivity of an antenna is

    (a) Unity   (b) Zero

    (c) Infinite   (d) None

    (v)   Which among the following is regarded as a condition of an Endure array?

    (a) $\delta < \beta d$ (b) $\delta > \beta d$

    (c) $\delta = \pm \beta d$ (d) $\delta \neq \pm \beta d$

[Turn over

(vi) The direction of maximum radiation for a vertically aligned half-wave dipole is

    (a) along the dipole   (b) perpendicular to the dipole

    (c) same along all the directions   (d) all of these

(vii) In a resonant antenna,

    (a) Forward wave exist

    (b) Backward wave exist

    (c) Both forward and backward wave exist

    (d) None of these

(viii) If the gain of a Yagi-Uda antenna is to be increased from 7 dBi to 9 dBi, in the higher frequency region

    (a) An extra reflector should added

    (b) Diameter of the driven (feeder) element should be increased

    (c) Length of the driven (feeder) element should be increased

    (d) Extra director elements should be added

(ix) In Log periodic antenna, the ——— of the antenna is a logarithmically periodic function of frequency.

    (a) Directivity   (b) Bandwidth

    (c) Gain   (d) Impedance

(x) The phenomenon of reduction of signal strength due to variation in refractive index is called ———

    (a) wave tilting   (b) fading

    (c) diffraction   (d) scattering

2. (a) A radiating element of length 10 m carries a current of 1 amp. It radiates in $\theta = 30°$ direction in free space at f = 3MHz. Estimate the magnitudes of E and H at a point located at 100 km from the point of origination. (5)

    (b) Why an alternating current element is called a Hertzian dipole? (3)

    (c) (i) Define Directivity

       (ii) Show that the directivity of a half wave dipole is 1.66. (2+5=7)

3. (a) Draw the horizontal and vertical pattern of centre-fed vertical dipole of length 1.5λ (5)

(b) The radiation intensity of an antenna is given by (6)

$$U(\theta,\phi)=U_0\left[1-\sin(2\theta)\right]$$

Where U_0 is a constant Calculate

(i) the direction of maximum

(ii) the value of U_0 such that the total radiated power is 1 Watt.

(iii) an expression for the directivity and its maximum value.

(c) Explain effective aperture area with its types (4)

4. (a) Define broad side array. Compare it with end fire array. (4)

(b) Draw the radiation pattern for a Broadside array of 4 sources λ distance apart. (6)

(c) Derive the expression for FNBW of an Endfire array of n sources. (5)

5. (a) Design a 4-element, broadside array of isotropic elements spaced $\lambda/2$ apart, for a side lobe ratio of 25dB. (7)

(b) What is the advantage of pattern multiplication explain the principle of pattern multiplication with an example. (6)

(c) What are the parameters to be considered for the design of a helical antenna? (2)

6. (a) How does a log periodic antenna provides a large bandwidth design a log-periodic antenna that has a directivity of 8.5 dB over a frequency range of 10 MHz to 30 MHz. Consider $\tau=0.895$ and $\sigma=0.166$. (8)

(b) Write the advantages and disadvantages of Microstrip Patch antenna. (5)

(c) Define sky wave. (2)

7. (a) What is smart antenna? What are its benefits? (4)

(b) Explain how wave propagation takes place in Ionosphere. (5)

(c) What are diversity schemes? Why is it required? Explain with neat diagrams. (6)

ECE 181801

3