10EC64

Sixth Semester B.E. Degree Examination, Jan./Feb.2021
Antenna and Propagation

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1   a. Explain the following parameters with respect to antenna systems:
    (i)   Directivity
    (ii)   Radiation intensity
    (iii)   Beam width   **(09 Marks)**

   b. Show that maximum effective aperture of $\frac{\lambda}{2}$ dipole is $0.13\lambda^2$.   **(06 Marks)**

   c. State and prove Frii's transmission formula.   **(05 Marks)**

2   a. Find the directivity for the source with unidirectional cosine squared power pattern.
                                                           (05 Marks)

   b. Derive the expression for Array factor in case of linear array of 'n' isotropic sources of equal amplitude and spacing.   **(10 Marks)**

   c. A linear array consists of 4 isotropic point sources. The distance between adjacent elements is $\frac{\lambda}{2}$. The power is applied with equal magnitude and a phase difference of $-dr$. Obtain the field pattern and find BWFN and HPBW.   **(05 Marks)**

3   a. Derive an expression for radiation resistance of a short electric dipole.   **(08 Marks)**
   b. Write short notes on folded dipole antennas.   **(06 Marks)**

   c. For a short dipole $\frac{\lambda}{15}$ long, find the efficiency, radiation resistance if loss resistance is 1 Ω. Find also the effective aperture.   **(06 Marks)**

4   a. Derive an expression for far field components of a small loop antenna.   **(08 Marks)**
   b. State and explain the Babinet's principle.   **(06 Marks)**
   c. Obtain the value of impedance of slot antenna in terms of its complimentary dipole antenna impedance Z_d.   **(06 Marks)**

PART – B

5   a. Explain the features of an helical antenna and the practical design considerations of the helical antenna.   **(10 Marks)**
   b. Write short notes on:
    (i)   Yagi-Uda antenna
    (ii)   Sleeve antenna.   **(10 Marks)**

6   a. Explain different types of rectangular and circular horn antennas. Also derive the design equations for rectangular horn antennas.   **(10 Marks)**
   b. Explain : (i) Turnstile antenna   (ii) Ultra wide band antennas.   **(10 Marks)**

7   a.   Draw and explain different ionized layers in ionospheric propagation.   **(10 Marks)**
    b.   Explain duct wave propagation.   **(05 Marks)**
    c.   Explain the phenomenon of Faraday Rotation and how measurement of total electron content is done for an ionospheric propagation.   **(05 Marks)**

8   a.   Define the terms with respect to wave propagation :
        (i)   Skip distance
        (ii)   Critical frequency.
        (iii)   Virtual height.
        (iv)   Maximum usable frequency.   **(08 Marks)**
    b.   Derive the expression for critical frequency in terms of maximum electron density N_{max} .   **(09 Marks)**
    c.   A HF radio link is established for a range of 2000 km. If the reflection region of the ionosphere is at a height of 200 km and has a critical frequency of 6 MHz. Calculate MUF.   **(03 Marks)**

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