USN ☐☐☐☐☐☐☐☐☐☐

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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