



## III B. Tech II Sem Supply End Examination, January 2023

**Antennas and Propagation**

(Electronics and Communication Engineering)

**Time: 3 Hours.****Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part - A, answer all questions which carries 20 marks.

3. In Part - B, answer any one question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

**PART- A****(10\*2 Marks = 20 Marks)**

- |       |  |    |     |    |
|-------|--|----|-----|----|
| 1. a) | Draw the linear plot of power pattern and its associated lobes and beam widths   | 2M | CO1 | L2 |
| b)    | Define the partial directivity of an antenna for a given polarization in a given direction.  | 2M | CO1 | L4 |
| c)    | What are the advantages of Binomial array?   | 2M | CO2 | L1 |
| d)    | Given a linear, end-fire, uniform array of 10 elements with a separation of $\lambda/4$ between the elements, find the directivity of the array? | 2M | CO2 | L3 |
| e)    | Why the reflector length is more than the driven element in Yagi-uda antenna?  | 2M | CO1 | L3 |
| f)    | What is the equivalent circuit of helical antenna in normal mode?  | 2M | CO1 | L3 |
| g)    | What type of polarization is obtained by microstrip antenna?   | 2M | CO1 | L3 |
| h)    | Define the effective dielectric constant of microstrip antenna.  | 2M | CO1 | L1 |
| i)    | What is radio horizon?   | 2M | CO3 | L2 |
| j)    | What are the advantages of duct propagation?   | 2M | CO3 | L1 |

**PART- B****(10\*5 Marks = 50 Marks)**

- |      |   |    |     |    |
|------|---|----|-----|----|
| 2 a) | What are the different field regions of antenna? explain how the shape of radiation pattern changes in this fields?   | 5M | CO1 | L1 |
| b)   | The radial component of the radiated power density of an antenna is given by $W_{rad} = \frac{A_0 \sin \theta}{r^2} \hat{a}_r$ W/m <sup>2</sup> where $A_0$ is the peak value of the power density, $\theta$ is the usual spherical coordinate, and $\hat{a}_r$ is the radial unit vector. Determine the maximum directivity of the antenna and express the directivity as a function of the directional angles $\theta$ and $\phi$ . | 5M | CO1 | L4 |

**OR**

- |   |   |     |     |    |
|---|---|-----|-----|----|
| 3 | State reciprocity theorem and Prove that the effective length of antenna in transmitting and receiving modes is same. | 10M | CO1 | L2 |
|---|---|-----|-----|----|

- 4 a) The z-plane array factor of an array of isotropic elements placed along the z-axis is given by  $AF = z(z^4 - 1)$ . Determine the  
 (i) number of elements of the array. If there are any elements with zero excitation coefficients (null elements), indicate it  
 (ii) position of each element (including that of null elements) along the z axis  
 (iii) magnitude and phase (in degrees) excitation of each element  
 b) Compare the broad side and end-fire arrays in all aspects. 5M C01 L2
- OR**
- 5 Explain the 3 antenna method to measure the gain of an antenna with neat set up diagrams and write advantages of this method. 10M C02 L1
- 6 a) Draw the geometry of helical antenna in axial mode and determine the value of axial ratio. 6M C01 L2  
 b) How the folded dipole gives higher impedance compared to the dipole? 4M C01 L3
- OR**
- 7 What are the different types of design methods are there for the horn antenna? Explain them and draw its structure. 10M C01 L2
- 8 a) Draw the different shapes of patches used in microstrip antenna and compare them. 5M C01 L3  
 b) How many images are formed in 60 degrees corner reflector and explain its working. 5M C01 L2
- OR**
- 9 What are the different feeding methods are there for parabolic reflector? Explain them with neat diagrams. 10M C01 L1
- 10 a) Derive the Friis formula for ground wave propagation 5M C03 L1  
 b) Explain the effects of ionosphere on wave propagation. 5M C03 L2
- OR**
- 11 Define the following terms: 10M C03 L1  
 (i) Critical frequency (ii) Skip distance (iii) MUF (iv) LUF (v) Virtual height