

**Faculty of Engineering & Technology**  
**Fifth Semester B.E. (Electronics Communication/  
Electronics Telecommunication) (C.B.S.) Examination**  
**ANTENNA AND WAVE PROPAGATION**

Time : Three Hours]

[Maximum Marks : 80

**INSTRUCTIONS TO CANDIDATES**

- (1) All questions carry marks as indicated.
  - (2) Due credit will be given to neatness and adequate dimensions.
  - (3) Assume suitable data wherever necessary.
  - (4) Illustrate your answers wherever necessary with the help of neat sketches.
  - (5) Use of Smith Chart is permitted.
1. (a) State the various types of transmission lines used in practice and derive the transmission line equation in terms of voltage and current. 8
- (b) The characteristic impedance of a certain line is  $710 \angle -16^\circ$ . When the frequency is 1 kHz, at this frequency the attenuation is 0.01 neper/km and the phase function is 0.035 radians/km. Calculate the resistance, the leakage inductance and the capacitance per km and velocity of propagation. 6

**OR**

2. (a) Derive the input impedance for a radio frequency line terminated in  $Z_R$ . 8
- (b) Calculate standing wave ratio and reflection coefficient on a line having  $Z_0 = 300 \Omega$  and terminated in  $Z_R = 300 + j400 \Omega$ . Show the calculated value of reflection coefficient and standing wave ratio on Smith chart. 6
3. (a) Derive the expression for the radiated field from an infinitesimal dipole. Deduce the field quantities for power radiation and radiation resistance expressions. 7
- (b) Find the radiation resistance of a small dipole of length  $\lambda/40$ ,  $\lambda/60$  and  $\lambda/80$ . 3
- (c) State the different applications of folded dipole. 3

OR

4. Write a short note on any **THREE** : 13
- Hertzian dipole and its application
  - Loop antenna and its application
  - Half wave length dipole and its application
  - Folded dipole and its application.
5. (a) Derive the expression for electric field of a broadside array of  $n$  sources and also find the maxima and minima direction along with half power point direction. 5
- (b) Define pattern multiplication in brief. 5

- (c) If an array of isotropic radiator is operated at a frequency of 6 GHz and is required to produce a broad side beam, find Null-to-Null beam width. If the array length is 10 m. Also find the directivity. 3

OR

6. (a) Explain the geometry of a log periodic antenna. Give the design equation and uses of log-periodic antenna. 6
- (b) (i) Explain how Dolph-Chebyshev method is useful for array analysis.
- (ii) Design four element broadside array of  $\lambda/2$  spacing between the elements. The pattern is to be optimum with a side lobe level 19.1 dB down the main lobe maximum. 7
7. (a) What is microstrip antenna? Explain the different feeding methods for microstrip antenna. 7
- (b) Design a rectangular microstrip antenna using a substrate (RT/duroid 5880) with dielectric constant of 2.2,  $h = 0.1588$  cm so as to resonate at 10 GHz. 6

OR

8. (a) Explain the concept of fringing effects of microstrip antenna and give the formula for width and length of microstrip antenna. 7
- (b) Design a circular microstrip antenna using a substrate (RT/duroid 5880) with a dielectric constant of 2.2,  $h = 0.1588$  cm so as to resonate at 10 GHz. 6

(Contd.)

9. (a) What are the different types of horn antenna ?  
Explain pyramidal horn antenna in detail. 7

(b) Write short notes on any **TWO** :

(i) Casse grain dual reflector

(ii) Aperture antenna applications

(iii) Plane reflector. 6

**OR**

10. (a) The aperture dimensions of a pyramidal horn antenna are  $16 \times 8$  cm. If is operating at a frequency of 8 GHz. Find the beam width, power gain and directivity. 5

(b) Explain the working principle, radiation pattern and applications of the corner reflector; also compare corner reflector with parabolic reflector. 8

11. (a) State reciprocity principle in antenna measurement. 6

(b) Explain the different techniques to measure antenna gain and explain one in detail. 8

**OR**

12. (a) Explain in brief fading, noise and interference. 6

(b) What are the types of measurement ranges ? 4

(c) Which layer is suitable for propagation of high frequency signals ? Why ? 4