

SECTION - B

16120(J) *June-16*

**B. Tech 6th Semester Examination**  
**Antenna and Wave Propagation (NS)**

EC-323

Time : 3 Hours

Max. Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt any five questions by selecting one Question from each of the section A, B, C, D and section E is compulsory.

SECTION - A

1. (a) Define effective aperture and effective length. Find the effective length of small dipole and  $\lambda/2$  dipole with current distribution of triangular and sinusoidal respectively. (10)
- (b) Define directivity and gain. The radiation intensity of the antenna is  $U=U_m \cos^n\theta$ . Prove that directivity for a source with a unidirectional pattern can be expressed as  $D(\theta) = 2(n+1)$   
Find the directivity  
(i)  $U=U_m \cos\theta$  (ii)  $U_m \cos^2\theta$  (10)
2. (a) Explain pattern multiplication in antenna array. Obtain the radiation pattern of eight isotropic sources with spacing  $\lambda/2$  and in phase. Use pattern multiplication. (10)
- (b) Derive the array factor of N-element uniform linear array and hence deduce the condition under which the array will radiate in broad side and end-fire direction. (10)

[P.T.O.]

3. (a) Explain with sketches a helical antenna and describe its operation in axial mode. How does it differ from other antenna? Also write its applications. (10)
- (b) Derive the expression for radiation resistance of short dipole and also  
Find.  
(i) The radiation resistance of a 10m length dipole operated at 500 KHz.  
(ii) How long must this antenna be for radiation resistance of  $1\Omega$ . (10)

4. (a) Derive the expression for far field of half wave dipole. Also find its radiation resistance using the far field. (10)
- (b) Explain with the help of appropriate sketches, the working of log-periodic antenna. What are its practical applications? (10)

SECTION - C

5. (a) What are the various feeding methods of parabolic reflectors? Explain each method with suitable diagram and also explain which method is best and why? (10)
- (b) Explain how the directivity and gain of antenna can be measured. (10)
6. (a) Write a short note on following:  
(i) Impedance measurement of antenna.  
(ii) Radiation pattern measurement. (10)
- (b) Discuss the design of corner reflector and flat sheet reflector. (10)

## SECTION - D

7. (a) A television transmitting antenna mounted at a height of 120m radiates 15 KW of power equally in all the directions in azimuth at a frequency of 50 MHz. Calculate (i) maximum line of sight range (ii) field strength at a receiving antenna mounted at a height of 16m at a distance of 12 km (iii) the distance at which field strength reduces to 1mV/m. (10)
- (b) Describe briefly the salient features of ground wave propagation. Explain the term "wave tilt of surface wave". (10)
8. (a) Assume that refraction takes place at a height of 400km and that maximum density in the ionosphere correspond to a 0.9 refractive index at 10 MHz. What will be the range for which the MUF is 10 MHz for flat earth and curved earth? (10)
- (b) Explain MUF, skip distance, critical frequency and multi-hop propagation. (10)

## SECTION - E

9. (i) What is retarded vector potential? What is significance of retarded potential?
- (ii) For isotropic radiator find the radiation intensity  $U_0$  when power radiated is  $P_{rad}$ .
- (iii) Find the maximum distance that can be conveyed by a space wave when the transmitting and receiving antenna heights are 80 m and 50 m respectively
- (iv) What are effects of ground on antenna input impedance and antenna performance?

- (v) What is Yagi-uda-antenna and what are its applications?
- (vi) What should be the polarization of electromagnetic wave for ground wave propagation? Justify your answer.
- (vii) Find the approximate beam area when the field expression is expressed as
- $$E(\theta, \phi) = \sin \theta \sin^2 \phi$$
- (viii) How to increase the radiation resistance of a loop antenna? Write down all the methods.
- (ix) What is array tapering?
- (x) What are different antenna measurement ranges? (2×10=20)