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)

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SECTION - B

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 1Ω.   (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

$E(\theta, \varphi) = \sin \theta \sin^2 \varphi$

(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)