WEST BENGAL UNIVERSITY OF TECHNOLOGY

EC-604A

ANTENNA THEORY & PROPAGATION

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. 10×1 = 10

(i) Space wave propagation occurs at frequencies

(A) below HF (B) in HF
(C) above HF (D) none of these

(ii) Ground wave propagation is widely used for

(A) AM broadcasting
(B) ship to ship communication
(C) over the horizon radar
(D) all of these

(iii) When the transmitter and receiver are separated by a skip distance the sky wave link must working at

(A) MUF (B) less than MUF
(C) LUHF (D) none of these

(iv) The true horizon based on geometric straight line of sight is

(A) $d(kms)=3.566\sqrt{h_t(mts)}$ (B) $d(kms)=4.266\sqrt{h_t}$ (mts)
(C) $d(miles)=3.566\sqrt{h_t(ft)}$ (D) $d(miles)=4.266\sqrt{h_t(ft)}$

(v) Radiation resistance of half wave dipole is

(A) 36.5Ω (B) 73 Ω (C) 377 Ω (D) none of these

(vi) The effective area and directivity are related by

(A) $D = \frac{4\pi A_e}{\lambda}$ (B) $D = \frac{4\pi A_e}{\lambda^2}$

(C) $D = \frac{12\pi A_e^2}{\lambda}$ (D) $A_e = \frac{8\pi D}{\lambda^2}$

(vii) Grating lobes occur when the spacing equals

(A) $\frac{\lambda}{2}$ (B) λ (C) $\frac{\lambda}{6}$ (D) 2λ

(viii) In the broadside array the principle maximum occurs, with respect to the length of the array

(A) along (B) perpendicular
(C) 45 degrees (D) none of these

(ix) The current amplitude distribution of Tschebyshev array is

(A) uniform (B) symmetric
(C) inverse tapered (D) none of these

(x) The radiation pattern of folded dipole antenna

(A) bi directional (B) omni directional
(C) isotropic (D) all of these

(xi) In Cassi Grian feed the sub reflector is

(A) paraboloid (B) hyperboloid
(C) ellipsoid (D) spherical

(xii) The fringing fields make the patch

(A) electrically wider (B) electrically narrower
(C) no change (D) none of these

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Define the following antenna parameters: 5
   (i) Gain
   (ii) Radiation intensity
   (iii) Directive gain
   (iv) Directivity
   (v) Antenna efficiency

3. Define the following terms: 2.5×2
   (i) Friss transmission formula
   (ii) Duality Principle

4. (a) Define retarded vector potential. 2+3
   (b) Calculate the power density at 100 feet for 100 watts transmitted through an antenna with a gain of 10.

5. Define Yagi-uda antenna and explain it's operation. 5

6. (a) What do you mean by antenna Band-width & Beam-width? 2+3
   (b) An antenna has a loss resistance 10 ohms, power gain of 20 & directivity 22. Calculate it's radiation resistance.

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) What do you mean by noise temperature of antenna? Derive the relation between gain and effective aperture of antenna. 2+3
   (b) The noise figure of an amplifier at room temperature (T = 290K) is 0.2dB. Find the equivalent noise temperature. 5
   (c) Discuss Self & Mutual impedance for antenna. 5

8. (a) What is Retarded Magnetic vector potential? 3+4+8
   (b) A 0.1m long thin wire is carrying 10A peak current at 30 MHz, and is oriented along the z-axis. Find the magnetic vector potential at a distance of 1m and 10m from the wire.
   (c) Find the Radiation Resistance of Hertz Dipole.

9. (a) A 1.2λ long dipole has 1/A peak input current. Find the maximum peak current seen on the dipole. If the dipole is oriented along the z-axis, find the radiation electric and magnetic fields at a distance of 100m along θ = 60°. 4+6+5
   (b) Find out the total Electric field and Array factor for a 2 element antenna array.
   (c) For the two element antenna array sketch the normalized field pattern when the currents are fed 90° out of phase and interelement spacing is $\frac{\lambda}{4}$.

10. (a) What is Wave tilt? 15
    (b) Deine MUF, Critical frequency and Virtual height.
    (c) Calculate the value of frequency at which an electromagnetic wave must propagate through the D region with an index of refraction 0.5 and an electron density 3.25×10^4 electron/m^3.

11. Write short notes on any *three* of the following: 3×5
    (a) Quarter wave Monopole antenna
    (b) Phased Array antenna
    (c) Microstrip Antenna
    (d) Skip Distance
    (e) Duct Propagation.