



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : EC-604A

ANTENNA THEORY & PROPAGATION

Time Allotted : 3 Hours

Full Marks : 70

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. Choose the correct alternatives for any ten of the following : 10 × 1 = 10

i) Gain is always than directivity.

- a) greater b) lesser
c) equal to d) none of these.

ii) Radiation resistance of antenna is

- a) Physical resistance b) Virtual resistance
c) both (a) and (b) d) none of these.

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iii) The induction and radiation fields of current element are equal at distance of

- a) $\lambda/2$ b) $\lambda/4$
c) $\lambda/6$ d) $\lambda/10$.

iv) In a Uniform Linear array all elements are fed with a current of amplitude.

- a) equal b) unequal
c) both (a) and (b) d) none of these.

v) In a Broad side array the radiation is along

- a) X-direction b) Y-direction
c) both (a) and (b) d) none of these.

vi) Yagi-Uda antenna consists of

- a) Folded Dipole b) Reflector
c) Director d) all of these.

vii) The radiation resistance of folded dipole of equal radii is

- a) 657 ohm b) 292 ohm
c) 300 ohm d) 277 ohm.

viii) Radiation resistance of a hypothetical current element of length dl is

- a) $800 (dl/\lambda)^2$ b) $400 (dl/\lambda)^2$
c) $800 (dl/\lambda)$ d) $400 (dl/\lambda)$.

ix) antenna array has no side lobe.

- a) End-fire array b) Back-fire array
c) Broadside array d) Binomial array.

x) Identify the incorrect statement :

- a) Dipole antennas are balanced antennas if fed by two conductor transmission line
b) Dipole antennas are unbalanced antennas if fed by two conductor transmission line
c) Dipole antennas are narrowest bandwidth antenna
d) Short dipole has the same directivity as that of small loop

xi) Which of the following terms do not apply to the Yagi-Uda antenna ?

- a) Good bandwidth b) Parasitic elements
c) Folded dipole d) Fixed frequency.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Distinguish between isotropic and directional radiators, resonant and non-resonant antenna.
3. Define retarded vector potential. Why is array antenna preferred over a single radiator ? $2 + 3$
4. Explain radiation resistance of an antenna. Write the applications of reflector antennas. $2 + 3$
5. Derive the equation to show that the radius curvature of path in troposphere is a function rate of change of dielectric constant with height. Draw the necessary diagram.
6. Calculate the maximum single hop distance for D, E, F₁ and F₂ layers if their heights are assumed to be 70, 130, 230 and 350 km respectively above the earth and the angle of incidence is 15° in all cases.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Explain the following terms as related to antenna system :
- i) Directivity ii) HPBW iii) Effective length
 - iv) Beam efficiency. 8
- b) Explain radiation mechanism of antenna with a two wire line. 7
8. a) Show that the refraction phenomena in the ionosphere is governed by the relation of refractive index (n) of the media with electron density (per cubic metre) and frequency in kHz. 9
- b) The critical frequencies at an instant observed for E, F1 and F2 layers were found to be 3, 5, 9 MHz. Find the corresponding maximum concentration of electrons in these layers. Calculate the critical

frequencies for these layers if N_{max} of each corresponding layer reduces to 80% of the values obtained. 6

9. a) Define critical frequency and maximum usual frequency in ionospheric propagation. Derive the relation between these two parameters. 4 + 3
- b) Define virtual height and skip distance as used in ionospheric propagation. Draw the diagram showing actual height and virtual height. Explain the reason for this difference in height. Explain with reason, the 'ordinary' and 'extraordinary' characteristic waves. 4 + 2 + 1 + 1
10. a) With the help of Maxwell's equation, explain how radiation and reception of electromagnetic wave take place. 6
- b) A dipole antenna of length 5 cm is operated at a frequency of 100 MHz with terminal current $I = 120\text{mA}$. At time $t = 1 \text{ sec}$, $\theta = 45^\circ$ and $r = 3\text{m}$
- Find (a) E_r (b) E_θ and (c) H_θ 9

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11. Write short notes on any *three* of the following : 3 × 5

- a) Microstrip Antenna
- b) Antenna Temperature
- c) Fading in sky wave propagation
- d) Ground wave propagation
- e) Duct Propagation.

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