Printed Pages : 4 **TEC-505**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3089 Roll No.

B. Tech.

(SEM. V) EXAMINATION, 2007-08

ANTENNA & WAVE PROPAGATION

Time : 3 Hours] *[Total Marks : 100*

Note : *Answer all questions.*

1 Answer any **four** of the following : **4×5=20**

(a) Derive the field component present at a distance r, making an angle θ from a vertical short electric dipole for far field only.

(b) Define directivity and antenna gain of any antenna. Derive the conduction for which both are same.

(c) What is radiation resistance of an antenna ? Show that the radiation resistance of a halfwave dipole is 73 ohms.

(d) Prove that the radiation field of a half-wave radiator is zero in the direction of its axis. Sketch the radiation diagram. Calculate HPBW.

(e) Derive reciprocity theorem for antennas. Show that the transmitting and receiving radiation patterns of an antennas are equal.

(f) Explain the significance of the term "effective area" of an antenna. How is this related to gain of the antenna ?

2 Answer any **two** of the following : **2×10=20**

(a) State the principle of pattern multiplication. State clearly the difference between a broadside array and end-fire array. Discuss the radiation pattern of a linear array of the three isotropic sources spaced $\frac{\lambda}{2}$ apart. The excitation of the sources are in-phase and have amplitude ratio 1 : 2 : 1.

(b) Define antenna array and classify it. Show that the resultant field in a direction making an angle θ with the line of an array consisting of N aerials equally spaced 'd' apart and carrying equal aerial currents and is phase is given by $F = F_0 \frac{\sin\left(\frac{N\psi}{2}\right)}{N \sin \psi/2}$ where F_0 is the value of maximum field and $\psi = \frac{2\theta}{\lambda}(d \cos \hbar)$.

(c) For an N-element of length $\lambda/2$ and vertically aligned uniform linear array, derive an expression for the array factor. Draw the radiation pattern if $N = 4$ and spacing between element $d = \frac{\lambda}{2}$ and consider all the elements to be in phase.

3 Answer any **two** of the following : **2×10=20**

(a) Explain the principle of tropospheric propagation. What type of antennas are used for tropospheric link and why ? Derive the maximum range that can be covered in LOS propagation. Discuss two application of LOS link.

(b) Distinguish clearly between "surface wave", "space wave" and "sky wave". Explain briefly the terms 'skip distance', 'MUF' and 'vertical height' as used in ionospheric propagation.

(c) Describe ground wave propagation. What type of polarization is used ? What is the frequency used ? Bring out various salient features of ground wave propagation in your discussion. Give two applications also.

4 Answer any **two** of the following : **2×10=20**

(a) Describe the principle of operation of the rhombic antenna, explaining, how the various parameters of the antenna control the radiation pattern. Mention the advantages and disadvantages of rhombic antenna.

(b) Describe how a loop antenna can be used for direction finding of an incoming E. M. waves. Derive expression for the voltage induced in the loop. Discuss helical antenna geometry and its features in normal and axial mode of operation.

(c) What is a Yagi antenna ? Explain its construction and properties with special reference to directivity and bandwidth. Make a comparative analysis between a Yagi antenna and a rhombic antenna. Design a Yagi antenna of 5 elements for freq. band 61-68 MHz.

5 Attempt any **four** of the following : 4×5=20

(a) Describe the slotted line technique for impedance measurement.

(b) Describe the 3-antenna method for gain measurement.

(c) Write a short notes on measurement of noise figure and noise temperature of an antenna.

(d) Explain the method of phase measurement of an antenna.

(e) Explain near field and far field radiation pattern measurement.