

13/12/22 (M)

Exam.Code:0929

Sub. Code: 6595

2122

B.E. (Electronics and Communication Engineering)

Fifth Semester

EC-503: Antennas and Wave Propagation

Time allowed: 3 Hours

Max. Marks: 50

**NOTE:** Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

I. Attempt the following:-

- a) Distinguish between antenna bandwidth and antenna beam-width.
- b) What is the basic condition for frequency independent antennas?
- c) Define the terms 'Lowest Usable frequency' and 'Skip Distance'.
- d) Discuss the effect of earth's magnetic field on ionospheric propagation.
- e) A thin dipole antenna is  $\lambda/15$  long. If its loss resistance is  $1.5 \Omega$ , find radiation resistance and efficiency. (5x2)

UNIT - I

- II. a) Derive an expression for radiated power for infinitely small element carrying alternating current.  
b) Explain the principle of pattern multiplication and find the array factor of a two element array. (2x5)
- III. a) Calculate the effective length of a ferrite rod receiving antenna which has 120 turns wound on a 1.40 cm diameter ferrite rod which has a relative permeability of 160. Assume the length factor to be 0.75 and frequency to be 1MHz.  
b) Prove that the directive gain and the effective area of an antenna is a universal constant. (2x5)
- IV. With the aid of appropriate sketches, explain fully the operation of Yagi-Uda array. List its applications. Why is it called a supergain antenna? (10)

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(2)

**UNIT - II**

- V. a) State and discuss the conditions of total reflection of radio waves from the ionosphere. Prove that the skip distance  $D$  for a given frequency is given by

$$D = 2h \left\{ \left( \frac{f}{f_c} \right)^2 - 1 \right\}^{1/2}$$

where  $h$  is the effective height of the reflecting layer and  $f_c$  the critical frequency of the layer.

- b) How the field pattern of a receiving antenna is experimentally found? Discuss. (2x5)

- VI. a) What do you understand by the term critical frequency? Calculate the critical frequencies for the  $F_1$ ,  $F_2$ , and  $E$  layers for which the maximum ionic densities are  $2.3 \times 10^6$ ,  $3.5 \times 10^6$  and  $1.7 \times 10^6$  electrons per c.c. respectively.

- b) What is fading? How is it caused? (2x5)

- VII. a) Write short note on whip antenna. Is Log periodic antenna a frequency independent? Explain its principle of operation.

- b) Distinguish clearly between ground wave, surface wave, space wave and ionospheric wave. (2x5)

x-x-x