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Roll No. :

328553(28)

B. E. (Fifth Semester) Examination, April-May 2021

(New Scheme)

(Et&T Branch)

ANTENNAS & WAVE PROPAGATION

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Attempt all questions. Part (a) of each question is compulsory and carries 2 marks. Attempt any two parts from (b), (c) and (d) of each questions and they carry 7 marks each.

Unit-I

1. (a) Define dominant mode in a wave guide. Write dominant modes TE & TM in a rectangular wave guide having dimensions a cm \times b cm, where $a > b$. 2

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- (b) Deduce the expression for cutoff wavelength, guide wavelength, phase constant, group and phase velocities in case of a rectangular wave guide excited in TM mode. 7
- (c) If the dimensions of the waveguide are 3.5 m × 2.0 cm and the frequency of operation is 10 GHz, determine all the possible TE and TM modes that can be propagated in this waveguide. 7
- (d) Write the advantages of a circular waveguide over a rectangular waveguide. Draw the field pattern of dominant TE and TM modes in a circular waveguide. 7

Unit-II

2. (a) Write different modes of wave propagation and the frequency range in which they are suitable. 2
- (b) Derive the field expression at receiver for space wave propagation assume flat earth. 7
- (c) A VHF communication is to be established with 35 W transmitter at 90 MHz. Find the distance up to which line of sight communication may be possible

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- if the height of the transmitting and receiving antennas are 40 m and 25 m respectively. Also determine the field strength at the receiver end. 7
- (d) Explain the term MUF and skip distance. Show that on flat earth the skip distance for a given frequency is given by $D_{\text{skip}} = 2h \sqrt{\left(\frac{f}{f_c}\right)^2 - 1}$. 7

Unit-III

3. (a) What is a Short Dipole? Define radiation resistance of an antenna. 2
- (b) Find the expression for magnetic field,

$$H_d = \frac{I_m dl \sin \theta}{4\pi} \left[-\frac{w}{Cr} \sin wt_1 + \frac{1}{r^2} \cos wt_1 \right]$$

$$\text{where } t_1 = \ell - \frac{r}{c}$$

when a current $I = I_m \cos wt$ is applied to the small current element. 7

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- (c) A transmitting antenna having an effective height of 61.4 meters, takes a current of 50 A at a wavelength of 625 m. Find :
- (i) R_r
 - (ii) Antenna efficiency for R_T of 50 ohm.
- (d) Define directivity of an antenna. Find the directivity of a short dipole antenna.

Unit-IV

4. (a) What is Tchebycheff Polynomial? 2
- (b) Explain various form of antenna arrays. 7
- (c) Derive an expression for radiation pattern for an array of "n" isotropic point sources for broad side case and plot the pattern when $n = 6$, take $d = \lambda/2$, for broadside case. 7
- (d) What do you mean by tapering of antenna arrays? Design a 4-element broadside array of $\lambda/2$ spacing between elements. The pattern is to be optimum with a side lobe level of 19.1 dB down the main lobe maximum. 7

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Unit-V

5. (a) What is antenna top loading and turning? 2
- (b) Explain loop antenna as a direction finder. How sense of direction is determined in direction finding applications? 7
- (c) What is Log-periodic antenna? Mention important characteristics of this antenna. 7
- (d) What is microstrip antenna? How it is made? And where they are used? 7

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