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328553(28)

B. E. (Fifth Semester) Examination, April-May 2018

(New Scheme)

(Specialization : Electronics and Communication Engg.)

(Et & T Engg. Branch)

ANTENNAS and WAVE PROPAGATION

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

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

Unit-I

1. (a) Define dominant mode in a waveguide. Write dominant mode for TE and TM modes in a rectangular waveguide. 2

(b) A rectangular waveguide has a cross section of 1.5 cm × 0.8 cm, $\sigma = 0, \mu = \mu_0, \varepsilon = \varepsilon_0$. ATM mode operating at 50 GHz is propagating in this air filled waveguide. If

$$H_z = H_0 \cos\left(\frac{\pi x}{a}\right)\cos\left(\frac{\pi y}{b}\right)\cos(wt - \beta z)\ A/M$$

Find :

(i) Mode of operation

(ii) Propagation constant

(iii) Cut off frequency

(iv) Cut off wavelength

(v) Intronsic impedance

(c) Show that, for equal cut off wavelength.

$$\frac{A_c}{A_r} = 2{\cdot}17, \text{ [Note } p_{11} = 1{\cdot}84 \text{]}$$

A_c = area of circular waveguide, A_r = area of rectangular waveguide. 7

(d) An air filled circular waveguide is to be operated at a frequency of 7GHz and is to have dimensions such

that $f_c = 0{\cdot}8f$ for TE_{11} mode. Determine diameter of the waveguide and guidewave, length, phase velocity. $P_{11} = 1{\cdot}841$. 7

Unit-II

2. (a) Define critical frequency and OWF. 2

(b) With reference to slay waves explain the following : 7

(i) Virtual Height

(ii) Fading

(iii) Skip distance

(iv) MUF

(c) Prove that : 7

$$E = \frac{88\sqrt{P}\ ht.hr}{\lambda d^2}$$

(d) The antenna of gain 2·2 of a VHF transmitter 5 kW at 62·25 MHz is located at a height of 40 meter above the surface of the earth. If the height of the receiving antenna of gain 1·6 is 10 meter only. What is the ultimate maximum distance upto which a lined-sight communication may be possible? Assume a

standard atmosphere what will be power received at this maximum distance. 7

Unit-III

3. (a) What do you mean by effective aparture and effective length? 2

(b) Derive reciprocity theorem for antenna. Write its application. 7

(c) A lossless half wavelength dipole antenna with input impedance $73\,\Omega$ is to be connected to a transmission line whose characteristics impedance is $50\,\Omega$. Assuming that the pattern of the antenna is given approximately by $U = B\sin^3\theta$. Find the over all maximum gain of this antenna. 7

(d) A grounded transmitting antenna having an efficiency of 11% and effective height of 1113 meter has a current at base of 725 ampear at a wavelength of 18·8 km. Calculate 7

(i) Value of lectric and magnatic field inlensities

(ii) Value of radiation resistance

(iii) Power radiated

(iv) Power in the antenna

(v) RMS value of voltage produced in receiving antenna at a distance of 175 km

Unit-IV

4. (a) Define antenna arrays and various forms of antenna arrays. 2

(b) Determine Dolph Tchebysheff Half current distribution for the minimum beam width of a linear phase broadside array of five isotropic unit sources. The spacing between sources is half wave length and the side lobe level is to be 20 db down. Also determine the half power beam width. 7

(c) Prove that the directivity of an end fire array of the two point sources spaced distance d apart is given by :

$$D(\theta) = \frac{2}{\left[1 + \left(\frac{\sin^2 \beta d}{2\beta d}\right)\right]}$$

(d) Derive and Draw field pattern for arrays of two point sources with equal amplitude and phase. 7

Unit-V

5. (a) Differentiate between resonant and non-resonant antenna. 2

(b) Comparison between Loop and Adlock direction friders and draw its structure. 7

(c) Write short notes on Horn Antenna with suitable diagram. Write equation for Horn length and directivity. 7

(d) Design and explain Rhombic antenna to operate at a frequency of 30 MHz with angle of elevation 30° with respect to ground. 7