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

PAPER ID : 3100   **Roll No.** | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION 2010-11

ANTENNA AND WAVE PROPAGATION

Time : 3 Hours   *Total Marks : 100*

Note :— (1)   Attempt **all** questions.

(2)   All questions carry equal marks.

1.   Answer any **four** parts of the following :—   **(5×4=20)**

(a)   Derive field components present due to a half wave-length Antenna. Find out the far field component.

(b)   Derive and draw the radiation pattern of thin center fed antenna of λ wavelength long. Calculate its radiation resistance half power beam width.

(c)   Define the following terms :—

(i)   Effective height

(ii)   Directivity.

(d)   An Omni directional antenna has a field pattern given by $E = 10I/r(V/m)$, where I = terminal current (A) and r = distance (m). Find the radiation resistance.

(e)   Derive the relationship between Effective height and Effective aperture.

(f) A receiver has an antenna with a total noise temperature 50 K, a physical temperature of 300 K, and an efficiency of 95%. Its transmission line has a physical temperature of 300 K and efficiency of 85%. The first three stages of the receiver all have 80 K noise temperature and 13 dB gain. Find the system temperature.

2. Answer any **two** parts of the following :—   **(10×2=20)**

(a) Classify Antenna Arrays. Derive and draw the field pattern of two Isotropic Antenna when the initial phase between them is :

   (i)   90° and

   (ii) 180°.

(b) How Binomial arrays are constructed from Linear Array ? Compute and plot the field pattern of a 3-source Binomial Array of Isotropic array and find its HPBW.

(c) Discuss the advantages of using the Dolph-Chebyshev distribution for the broadside linear array with equal spacing between elements. The center source of a five source array has a current amplitude of unity. For a side lobe level of 0·2 of the main-lobe maximum field, find the Dolph-Chebyschev value of the amplitude of the end sources. The source spacing $d = \lambda/2$.

3. Answer any **four** parts of the following :—   **(5×4=20)**

(a) What is free space propagation ? Derive the free space path loss.

(b) What do you understand by the term troposphere scattering ? Discuss the various factors that contribute to this result.

(c) Explain the mechanism of sky wave propagation.

(d) What are the frequency ranges in which Ground wave propagation takes place ? Explain its mechanism.

(e) Discuss magneto-ionic effect of the earth on radio waves.

(f) Calculate the value of Frequency at which an electromagnetic wave must propagate through the D-region with an index of refraction of 0·5 and an electron density of $3·24 \times 10^4$ electron/m³.

4. Answer any **two** parts of the following :— **(10×2=20)**

(a) Derive the field equation for TM mode of Propagation in rectangular wave guide. Deduce the field component for TM_{11} mode of propagation.

(b) Derive Cut-off Wavelength, Cut-off frequency, Guided wavelength and Characteristics wave Impedance of a rectangular wave guide of $2·2 \times 1·8$ cm² dimension. It operates at 9 GHz signal and the mode of propagation is TE_{11}.

(c) Derive the field component of TM mode in circular wave guide. For a dominant mode propagated in an air filled circular wave guide the cut-off wavelength is 10 cm. Find the Cross-section area of the guide and the frequency of operation. Given $P'_{nm} = 1·841$.

5. Answer any **two** parts of the following :— **(10×2=20)**

   (a) Describe the working principle and operation of Reflex Klystron.

   (b) Describe the working principle and operation of any one type of crossed field device.

   (c) Explain the working and salient features of TRAPATT Diode and Gunn Diode. Write down two applications of both the devices.