

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

**PAPER ID : 3100**

**Roll No.**

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**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  $\lambda$  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)  $90^\circ$  and

(ii)  $180^\circ$ .

- (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-Chebyshev 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/m<sup>3</sup>.

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  $2.2 \times 1.8$  cm<sup>2</sup> 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.