

B.Tech
(SEM V) THEORY EXAMINATION 2018-19
ANTENNA AND WAVE PROPAGATION

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

- 1. Attempt all questions in brief** **2 x 10 = 20**
- a. Define antenna temperature and antenna impedance.
 - b. Calculate the length of a half wave dipole antenna meant to have correct half wave length at 60 MHz.
 - c. Write the differences between broad side array and end fire array.
 - d. Calculate the directivity of a given linear broad side uniform array of 10 isotropic elements with a separation of $\lambda/4$ between the elements.
 - e. What is long wire antenna?
 - f. What are the drawbacks of Yagi antenna?
 - g. Write the differences between parabolic and corner reflector.
 - h. Write the different feed methods for micro strip antenna.
 - i. Define the term skip distance and maximum usable frequency used in ionospheric propagation.
 - j. Write the difference between ground wave, surface wave, space wave and ionospheric wave.

SECTION B

- 2. Attempt any three of the following:** **10 x 3 = 30**
- a. Define directivity of an antenna. Derive an expression between directivity and gain of an antenna.
A thin dipole antenna of directivity 100 is $\lambda/20$ long. Its efficiency is 90% and wave length of operation is 1 metre. What are its radiation resistance, loss resistance and maximum effective aperture?
 - b. Prove that the directivity of an end-fire array of the point sources spaced distance 'd' apart is given by

$$D(\Theta) = 2 / \left(1 + \frac{\sin 2\beta d}{2\beta d}\right)$$
 - c. What is Yagi antenna? Explain its construction and properties with reference to directivity and bandwidth. Also explain how the radiation pattern of Yagi antenna can be found?
 - d. Describe the construction and basic principle of operation of a helical antenna under normal mode of operation. What are its applications?
 - e. Discuss the effect of earth's magnetic field on the propagation of radio waves through the ionosphere. Find the skip distance for waves of frequency 4.6×10^6 Hz at a time when the maximum ionization in the E- region has a value of 10^{11} electrons/m³ at a height of 110 Km.

SECTION C

- 3. Attempt any *one part* of the following: 10 x 1 = 10**
- Define radiation resistance, efficiency, transmission bandwidth of an antenna. Derive an expression for the radiation resistance of a half wave dipole.
 - Define effective aperture and effective height of an antenna. Also derive an expression for the maximum effective aperture of a short wave dipole.
- 4. Attempt any *one part* of the following: 10 x 1 = 10**
- What is broad side array? Deduce an expression for the radiation pattern of the broad side array with n vertical dipoles. Sketch the radiation pattern in vertical and horizontal planes for such an array with four dipoles.
 - State the principle of pattern multiplication. Using principle of pattern multiplication sketch the horizontal pattern of four vertical radiators spaced one quarter wavelength and having a progressive phase shift of 90° between elements.
- 5. Attempt any *one part* of the following: 10 x 1 = 10**
- Derive an expression for the polar diagram of an end fire array consisting of point sources. How is the gain of the array with respect to an isotropic radiator influenced by the number of radiators?
 - What is folded dipole antenna? Describe the current distribution and radiation pattern of a folded dipole antenna. How is a folded dipole used in an antenna designed for TV receiver?
- 6. Attempt any *one part* of the following: 10 x 1 = 10**
- Describe how a loop antenna can be used for direction finding of an incoming EM waves. Derive an expression for the voltage induced in the loop. How can the sense of ambiguity be resolved?
 - Describe a Horn antenna. How is this antenna fed and what are its applications?
A pyramidal horn antenna has an aperture of 20 cm X 15 cm. Assuming the field distribution to be uniform over the aperture, calculate the maximum directivity and beam width of an antenna.
- 7. Attempt any *one part* of the following: 10 x 1 = 10**
- Describe the characteristics of space wave propagation, clearly explaining the difference between the radio and optical horizons. Also explain the phenomenon of super refraction. Where is it more likely to be prevalent?
 - Write technical notes on:
 - Multi Hop Propagation
 - Ground Wave Propagation
 - Abnormalities in ionosphere