

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

Time: 3 Hours

Total Marks: 70

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

SECTION A

- 1. Attempt all questions in brief. 2 x 7 = 14**
- a) Give reason why does retardation potential take place?
 - b) A thin dipole antenna is $1/15$ long if its loss resistance is 1.5 W. Find radiation resistance and efficiency?
 - c) What is end-fire array and broad-side array?
 - d) Define the gain of antenna?
 - e) Define virtual height and skip distance?
 - f) Estimate the distance & effective aperture of a paraboloid reflector antenna required to produce Null beam width of 10° at 3GHz.
 - g) Find the radiation efficiency of a 1m diameter loop of 10mm diameter copper wire at 10MHz.

SECTION B

- 2. Attempt any three of the following: 7 x 3 = 21**
- a) Calculate the effective aperture for a dipole antenna of length 2cm at a 1.2 GHz. What will be the power received for an incident power density of $2\text{mW}/\text{m}^2$.
 - b) Sketch the horizontal and vertical plane radiation pattern of Centre fed vertical dipole for the following length- (i) $\lambda/2$ dipole (ii) $3\lambda/2$ dipole (iii) 2λ dipole
 - c) What is folded dipole antenna? Describe Yagi-Uda antenna and explain its operation?
 - d) Explain the principle of operation of parabolic dish? Why is the parabolic shape is used?
 - e) Explain the phenomenon of Duct Propagation. What are the ionospheric conditions under which duct propagation can take place?

SECTION C

- 3. Attempt any one part of the following: 7 x 1 = 7**
- a) Discuss about antenna impedance and antenna temperature?
 - b) How the directivity of any antenna is defined and what is the relationship between directivity and gain of the antenna?
- 4. Attempt any one part of the following: 7 x 1 = 7**
- a) Explain the principle of pattern multiplication. Obtain the radiation pattern of 4 element fed in-phase, spaced $\lambda/2$ apart using pattern multiplication.
 - b) Define the isotropic sources? N-isotropic sources are arranged in a uniform linear array. Derive an expression for the array factor?
- 5. Attempt any one part of the following: 7 x 1 = 7**
- a) A linear broad-side array consists of four equal isotropic in-phase point source with $\lambda/2$ spacing. Find the directivity, BWFN and HPBW of the array?
 - b) An end fire array consisting of several half wavelength isotropic radiators has a directive gain of 30. Find the array length and width of the major lobe. What will be the value for broadside array?

6. Attempt any *one* part of the following:

7 x 1 = 7

- a) Explain with suitable diagram log periodic antenna? What are practical application of these antenna?
- b) A loop antenna consists of 10 turns, each having an area of 1 m². A radio wave having a frequency of 1 MHz induces a sinusoidal emf of 100 mV(rms) in this antenna when it is oriented for maximum response. Calculate the peak value of the magnetic field intensity of the RF wave. ($\mu_0=4\pi\times 10^{-7}\text{h/m}$)

7. Attempt any *one* part of the following:

7 x 1 = 7

- a) Assume that reflection take place at a height of 350km & that the maximum density in the ionosphere corresponds to a 0.8 refractive index at 15 MHz what will be range for which the MUF is 20MHz. Assume flat Earth.

- b) Derive expression for refractive index of ionosphere $\mu = \sqrt{1 - \frac{81N}{f^2}}$.