

2021

B.E. (Electronics and Communication Engineering)

Fifth Semester

EC-503: Antennas and Wave Propagation

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Use of scientific calculator is allowed.

x-x-x

- I. (a) Calculate the radiation efficiency of a short dipole which is $\lambda/15$ m long and it has $R_{\text{loss}}=1.5\Omega$. (2)
- (b) What is the difference between radian and steradian? (2)
- (c) Draw field pattern of an array of 4 isotropic point sources, separated by half wave length distance, (2)
- (d) Find the dimensions of a three elements Yagi-Uda antenna for 100 MHz operating frequency and 0.2λ inter element spacing. (2)
- (e) Draw the basic field paths in space wave propagation between transmitter and receiver? (2)

Part- A

- II. (a) Discuss the different field regions of an antenna. (5)
- (b) Find E for a linear array of N isotropic Point sources. (5)
- III. (a) Given a linear broadside uniform array of isotropic elements, ($N=\infty$) with a separation of $\lambda/4$ ($d=\lambda/4$) between the elements. Find the directivity of an array. (5)
- (b). Explain the impedance matching of an antenna using Baluns. (5)
- IV (a) Deduce an expression for the radiation pattern of an end-fire array with N vertical dipoles. (5)
- (b) A broadside array operating at 100 cm wavelength consists of four half wave dipoles spaced 50 cm. Each element carries radio frequency current in the same phase and magnitude 0.5 Amp. Calculate the radiated power. (5)

(2)

Part-B

- V. (a) State the Rumsey's principle and discuss the current criteria for the antenna to be frequency independent. Enlist the different frequency independent antennas and applications of it. (5)
- (b) A rhombic antenna in a horizontal plane is to radiate at 20° in the vertical plane. The operating frequency is 15 MHz. Find the required (i) tilt angle (ii) leg length (iii) height above ground. What will happen if rhombic antenna is not terminated by a suitable resistance? (5)
- VI. (a) Explain whip antenna. Explain its different characteristics. (5)
- (b) Find the range of LOS system when the receive and transmit antenna heights are 10m and 100m respectively. Take the effective earth's radius into consideration (5)
- VII. (a) A television transmitter antenna has a height of 169 meters and the receiving antenna has a height of 16 meters. What is the maximum distance through which the TV signal could be received by space propagation? What is the radio horizon in this case. (5)
- (b) Obtain expression for refractive index of an ionospheric layer. (5)

x-x-x