7E7081

Roll No. _____ Total No of Pages: 3

7E7081

B. Tech. VII - Sem. (Back) Exam., Feb.-March - 2021

Electronics & Communication Engineering

7EC1A Antenna & Wave Propagation

Time: 2 Hours **Maximum Marks: 48**

Min. Passing Marks: 15

Instructions to Candidates:

*Attempt **three questions**, selecting **one question** each from any three unit. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

1. NIL 2. NIL

UNIT- I

Q.1 (a) Define and explain the following terms of antenna : [8]

(i) Beam - width

(ii) Directivity

(iii) Effective aperture

(iv) Antenna efficiency

(b) What are the roles of an antenna in wireless technology? Explain how the concept of displacement current was introduced by Maxwell to account for the production of magnetic field in free space. [8]

OR

Q.1 (a) With the help of Maxwell's equation, explain how radian and reception of EM wave takes place. Isotropic radiator is only a theoretical concept; it cannot be designed practically. Why? [8]

(b) An antenna has normalized radiation intensity U (0, ∅) = 10 sin0 sin∅; W/sr for $0 < \theta < \Pi$ and $0 < \varnothing < 2\Pi$ and zero elsewhere. Find the radiated power and directivity. [8

UNIT- II

Q.2 What is phased array antenna? What is the main difference between BSA and EFA? Plot the normalized field pattern for BSA and EFA by considering an array of eight elements spaced at $\lambda/2$. [16]

OR

Q.2 Define the principle of pattern multiplication of an antenna array. A uniform linear array consists of 14 isotropic point sources with spacing of $\lambda/4$. Calculate. [16]

(a) Directivity

(b) Effective aperture. if the phase difference $\psi = -90°$

UNIT- III

Q.3 (a) Design a three-element Yagi – Uda antenna to operate at a frequency of 570 MHz. [6]

(b) What are the different categories of lens antennas? Explain the basic principle of operation of a dielectric lens antenna showing how it converts a spherical wave front into a plane wave front. Also derive the lens equation. [10]

OR

Q.3 (a) Calculate the design data of a rhombic antenna to operate at 50 MHz if the angle of elevation is 30°. [6]

(b) Design a rectangular micro – strip patch with dimensions W and L over a single substrate, whose center frequency is 10 GHz. The dielectric constant of the substrate is 10.2 and the height of the substrate is 0.127 cm. Determine the physical dimensions W and L (in cm) of the patch, taking into account field fringing. [10]

UNIT- IV

Q.4 (a) Explain the formation of ionosphere. What are the various layers of the ionosphere and their effects on wave propagation? With the help of a neat diagram show their height from the ground. [8]

(b) Explain with suitable diagram the "Multiple Hop Transmission". Also describe the effect of earth's magnetic field on ionosphere wave propagation. [8]

OR

Q.4 (a) What do you understand by duct propagation? Under what conditions are ducts formed? Discuss the frequency bands useful for duct propagation. What are its main limitations? [8]

(b) What is tropospheric scattering? What is the frequency range for it? What are the major conditions for its operation? [8]

UNIT- V

Q5 (a) Define the critical frequency and critical angle. How is critical frequency and critical angle related with electron density? [4]

(b) What are the effects of ground on antennas? What are grounded and ungrounded antennas? [4]

(c) A communication system is to be established at a frequency of 60 MHz with a transmitter power of 2kW. The field strength of the directive antenna is 5 times that of a half – wave antenna, $h_t = 60mm$, $h_r = 6m$. Field strength of 100 μV/m is required to give satisfactory reception. Find the range of the system. [8]

OR

Q5 (a) What is meant by fading? Also define skip distance and give the reasons why it varies. [4]

(b) Find the critical frequency if the maximum electron density is 1.3×10^6 electron/cm^3. Also calculate the critical angle of propagation for D-layers if the transmitter and receiver are separated by 450 km. [4]

(c) A high frequency radio link has to be established between two points at a distance of 2500 km on earth's surface. Considering the ionospheric height to be 200 km and its critical frequency 5MHz, calculate the Maximum Usable Frequency (MUF) for the given path. [8]