VIT UNIVERSITY

School of Electronics Engineering

CAT-I Winter 2019-2020

ECE 3010 Antennas and Wave Propagation

Course : B.Tech (ECE) Max Marks: 50

Faculty Name : K.Shambavi Time: 1 ½ hrs

Date of Exam : 20.01.2020 Slot : B1

Answer all the questions

1. What factors affect the wave propagation mechanism in free space. Give a brief note on each factor. (5)

2. A television transmitting antenna mounted at a height of 120 m radiates 15 kW of power equally in all directions in azimuth at a frequency of 50 MHz. Calculate (i) maximum line of sight range (ii) the field strength at a receiving antenna mounted at a height of 16 m at a distance of 12 km and (iii) the distance at which field strength reduces to 1 mV/m. (9)

3. A linearly polarised wave in free space with an electric field amplitude 30 V/m is incident on the plane boundary of a lossless non- magnetic medium with $\varepsilon_r = 2$ from an incidence angle of 45°. The electric field is perpendicular to the plane of incidence. Calculate (5)

   (i) the amplitude of transmitted electric and magnetic fields

   (ii) the amplitude of the reflected electric signal.

4. A high frequency radio link has to be established between two points at a distance of 1500 km on earth's surface. For a single hop transmission, the critical frequency at that time is 7 MHz. Calculate the maximum usable frequency and optimum working frequency for the given path. (5)

5. A television transmitter antenna has a height of 160 m and the receiving antenna has a height of 16 m. what is the maximum distance through which the TV signal could be received by space propagation? What is the radio horizon in this case. (4)

6. A linear dipole antenna of length 10 cm is oriented with its axis along z-direction and driven with a peak current of 10 A at a frequency of 1 MHz. (6)

   i. Determine the type of antenna at this frequency.

   ii. By what factor does the radiated electromagnetic field propagating through free space change between two locations situated at $R_1 = 50$ km and $R_2 = 150$ km from the antenna.

   iii. What is the value of power density at a distance of 50 km along the z-direction.

7. A 2-A source operating at 300 MHz feeds a Hertzian dipole of length 5 mm situated at the origin. (i) Find the electric and magnetic fields at (10, 30°, 90°) (ii) Radiation resistance at (10, 30°, 90°). (10)

8. A 1m long car radio antenna operates in the AM frequency of 1.5 MHz. How much current is required to transmit 4 W of power ? (6)