JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS-2022

B.Tech-VI Semester (GE/IE-Minor-in ECE)

COURSE CODE (CREDITS): 18B11EC513(3) MAX. MARKS: 35

COURSE NAME: Electromagnetic Waves

COURSE INSTRUCTOR: Dr. Salman Raju Talluri MAX. TIME: 2 Hours.

Note: All questions are compulsory. Marks are indicated against each question in square brackets. Assume any missing data.

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1. Write the Maxwell's equations in integral form, point form. Express $E_s = 20\cos(10^8 t - 0.75z)a_x\ V/m$ in Phasor quantity. [5 marks CO: 1]

2. A uniform plane wave in free space has electric field vector given by $E_s = 10e^{-j\beta x}a_z + 15e^{-j\beta x}a_y$. Determine the direction of propagation. Determine wave polarization. Find H_s. Determine the average power density in the wave in W/m^2. [5 marks CO: 3]

3. A lossless transmission line having characteristic impedance $Z_0 = 50\ \Omega$ is driven by a source at the input end that consists of the series combination of a 10-V sinusoidal generator and a 50 Ω resistor. The line is one-quarter wavelength long. At the other end of the line, a load impedance, $Z_L = 50 - j50\ \Omega$ is attached. Evaluate the input impedance to the line seen by the voltage source-resistor combination. Find the reflection coefficient, voltage standing wave ratio. Find the power delivered at the input of the transmission line. [5 marks CO: 4]

4. What do you mean by Transverse Electric (TE), Transverse Magnetic (TM) and Transverse Electric and Magnetic waves? Explain in detail about them with field components. [5 marks CO: 4]

5. Write the boundary conditions for electric field and magnetic field intensity at the interface between two dielectric material. Use them to solve the following:

   The surface x = 0 separates two perfect dielectrics. For x > 0 , let $\varepsilon_{r1} = 3$, while $\varepsilon_{r1} = 5$ where x < 0. If $E_1 = 80a_x - 60a_y - 30a_z$ V/m, find E_{N1} and E_{T1}. Find E_2 . [5 marks CO: 2]

6. What do you mean by impedance matching? How do you match a complex load using Smith chart. Give a suitable example. [5 marks CO: 3]

7. Define/Explain the following. [5marks Co-1 to Co-5]

   a. Draw the constant resistance and reactance circles with regard to Smith Chart.
   b. Equation of Continuity
   c. Intrinsic Impedance of free space
   d. Displacement current density
   e. Laplace and Poisson's equations.