Dr. Salman Raju

COURSE CODE: 10B11EC513   MAX. MARKS: 35

COURSE NAME: Electromagnetic Engineering

COURSE CREDITS: 03   MAX. TIME: 2.0 HRS

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Assume any missing data. Specify the assumptions you have made. Use scale, pencil and compass for the Smith chart solution.

1. A load impedance of $Z_L = 100 - j40\Omega$ has to be matched to a generator of characteristic impedance $Z_0 = 50\Omega$. Use the Smith chart to find two matching circuits for this load. Realize the matching circuit elements that you obtained using open circuited transmission line stubs. (6m)

2. The interface between two different media is a plane. A travelling EM wave in medium 1 is incidenting on the interface at angle of θ_i. The polarization of the wave is parallel i.e the electric field is in the plane of incidence). Derive the reflection coefficient and transmission coefficients for this case. (5m)

3. Find the capacitance between two concentric cylinders of inner radius $'a'$ and outer radius $'b'$ with a length of $'L'$ units using the Laplace's equation. (4m)

4. Define Biot-Savart's law and Ampere's circuital laws. Derive the expression for magnetic field intensity at a height of $'h'$ units from the center of the circular current carrying loop of radius $'a'$units. The current is I. (5m)

5. Define the Gauss's law. Verify the Gauss's divergence theorem over the closed surface $-1 < x < 1$, $-1 < y < 1$ and $-1 < z < 1$ if the electric field intensity is $E = xyza_x + (x + y + z)a_y + za_z V/m$. (5m)

6. The current density in a certain region is given by $J = \frac{1}{r^2}e^{-10^6 t}a_r \; A/m^2$. At $t = 1ns$, how much of the current is crossing the spherical surface $r = 1$. (2m)

7. A load impedance of $Z_L = 25 - j25\Omega$ has been connected to a transmission line of characterstic impedance of $Z_0 = 50\Omega$. Derive mathematically, where the second current minimum is appearing from the load. What is the input impedance of the line at this point?(3m)

8. Write briefly about the following. (5m)

     a. Circular polarization (1m)   b. Quarter wave transformer (1m)

     c. Maxwell's equations in phasor form (2m)   d. Distributed elements vs Lumped elements (1m)