R09

Code No: 54011

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech II Year II Semester Examinations, November/Decemher -2015

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

(Common to ECE, ETM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

- - -

1.a) Two point charges of 10 nC and - 10 nC are located at (0, 0, 2) and (0, 0, -2). Determine the force on a 1 nC charge located at (0, 2, 0) and the electric field at that point.

b) Given $\bar{E} = yz\hat{X} + zx\hat{Y} + xy\hat{Z}$ V/m, find the total energy stored in the region $0 \le x \le 1, 0 \le y \le 1, 0 \le z \le 1$. Is this a conservative field? [7+8]

2.a) A spherical capacitor has an inner and outer spheres of radii 10 cm and 20 cm. respectively, separated by a medium of relative permittivity 4.0. Find the resulting capacitance and the charge Q on inner sphere, when a potential difference of 5 volts is applied.

b) Define Gauss's Law, and hence calculate the field and flux density due to an infinite line having uniform charge density of ρ_L Coul/m. along the Z-axis.[7+8]

3.a) Define the Ampere's Circuital Law and hence calculate the magnetic field and magnetic flux density due to a long conducting wire of radius 2 cm, carrying a current of 5 mA, at a radial distance of 3 cm. Derive the expression used.

b) Explain the significance and utility of the parameters: Magnetic Scalar Potential and Magnetic Vector Potential. [8+7]

4.a) Explain and derive the modified Ampere's Law for time varying fields, and list out all the Maxwell's equations and continuity equation - in both differential and integral forms.

b) State the boundary conditions to be satisfied the tangential and normal components of magnetic fields at the surface of a perfect conductor. [8+7]

5.a) Show that a Uniform Plane Wave is a TEM Wave. Write the relations for E/H, $\bar{E}.\bar{H}$ and $\bar{E}\times\bar{H}$ for such a wave.

b) Given $\bar{H} = 50 \sin(2 \times 10^8 t - \beta z)\,\hat{Y}$ A/m in air, determine the direction of propagation, polarization, propagation constant, wavelength and $\bar{E}$. [8+7]

6.a) A UPW is normally incident from air onto a medium of $\varepsilon_r = 2$, $\mu_r = 2$, $\sigma = 0$. Estimate the reflection and transmission coefficients for electric field, deriving the expressions used.

b) With neat schematics, define and distinguish between Perpendicular and Parallel Polarizations, when a UPW is obliquely incident from air on to another dielectric medium. [7+8]

7.a) A 50 ohm distortionless line has R = 2 ohm/m. Find the other primary constants of the line, wavelength and the propagation constant at 200 MHz, if it has a velocity of 65% of velocity of light.

b) Sketch the equivalent circuit of a lossy line and estimate its input impedance, when it is terminated by Z_o. What is the concept of an infinite line? [7+8]

8.a) Starting from the input impedance of a lossy line, find the Z_{sc} and Z_{oc} of RF lines, and sketch their variations with length.

b) Write short notes on:
i) Single Stub Matching,
ii) Loading of Transmission Lines. [7+4+4]

---ooOoo---