Code: ICT 9A04406

ICT

B.Tech II Year II Semester (R09) Supplementary Examinations, April/May 2013

ELECTROMAGNETIC THEORY & TRANSMISSION LINES

(Electronics and Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Give the limitation of Gauss's law? And discuss some of its applications.

(b) Determine the charge density due to the following electric flux densities

(i) $D = 6xyi_x + 4y^2 i_y$ (ii) $D = r\sin\phi i_r + 2r\cos\phi\, i_\phi + 3z^2 i_z$

2 (a) The region between parallel plates of distance 'd' is filled with two dielectrics with conductivities σ_1, σ_2 for $0 < x < t$ and $t < x < d$ respectively, find the boundary conditions to be satisfied at $x = t$, find potentials in the two regions.

(b) Find the flux density at a point (0, 0, 5) due to a point charge of 10 nC at (0, 0, 2) and a line charge of density 10 nC/m along x-axis?

3 (a) Derive an expression for magnetic field at a point due to two long straight parallel wires carrying equal and opposite currents.

(b) A conductor carries a current of 5 amps along the x-direction. Find the force on it if it is subjected to a flux density of $1\ Wb/m^2$ along z-direction.

4 (a) Find the capacitance of an isolated sphere of radius 'R'.

(b) Considering earth as a conducting sphere of radius 6550 km, calculate the surface charge on it?

5 A uniform plane wave is propagating in a medium having the properties σ = 1 s/m, $Є_r$ = 36, μ_r = 4. The electric field is given by E = 100 $e^{-\alpha x}$ cos (10Π x 10^8 t-βx) a_z V/m. Determine α, and β and write time domain expression for the associated magnetic field vector.

6 A uniform sinusoidal plane wave in air with the following phasor expression for electric field intensity $E_i(x, z) = a_y 10e^{-j(6x + 8z)}$ v/m is incident on a perfectly conducting plane at z = 0.

(i) Find frequency and wave length of the wave.

(ii) Determine the angle of incidence.

(iii) Find $E_r(x, z)$ and $H_r(x, z)$ of the reflected wave.

7 An open wire transmission line terminated in its characteristic impedance has the following primary constants at 1 KHz. R = 6 Ω/km, L = 2 mH/km, C = 0.05 μF/km, and G = 0. 5 x 10^{-6} mhos. Calculate the phase velocity and the attenuation in db suffered by a signal in a length of 100 km.

8 A transmission line 100 m long operating at 100 MHz has the following constants $Z_0 = 50\angle -5^0$, α = 0.001 neper/m, β = $\frac{\pi}{1.8}$ rad/m. The transmission line is now connected to a load and the value of voltage reflection coefficient measured at a distance of 4 m away from the load is found to be $0.5\angle 30^0$. Calculate the input impedance of the line.

*****