7E4176

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B.Tech. (Sem.VII) (Main/Back) Examination- Dec. 2013
Electrical Engineering
7EE6.1 Electro Magnetic Field Theory

Time : 3 Hours

Total Marks : 80
Min. Passing Marks : 24

Instructions to Candidates :
Attempt any five questions selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

UNIT – I

1. (a) Explain concept and physical interpretation of gradient, divergence, and curl.
   (b) For a vector field A, show explicitly that $\nabla . \nabla \times A = 0$.

OR

(a) What is Stoke's Theorem? What are the advantages and limitations? Can Stoke's theorem be applied to closed surface? **(8)**

(b) Determine the divergence of these vector field

(i) $P = xyza_x + xza_y$

(ii) $T = \frac{1}{r^2}\cos\theta a_r + r\sin\theta\cos\phi a_\theta + \cos\theta a_\phi$ **(4 × 4)**

UNIT – II

(a) Derive Poisson's and Laplace's equations using Gauss Law **(8)**

(b) On a line described by x = 4, y = – 4m, there is a uniform charge distribution with density $\rho_l = 25nC/m$. Determine the electric field E at (–2, –1, 4)m **(8)**

OR

(a) Write short note on Uniqueness Theorem and its use. **(8)**

(b) Find the capacitance of 20 cm co-axial cable having an inner conductor with 0.0295m diameter, an outer conductor with inside diameter of 0.116m, and a polythene dielectric with $\varepsilon_r = 2.26$. **(8)**

UNIT – III

(a) Derive the formula for energy density stored in magnetic field **(8)**

(b) A circular loop conductor lying in z= 0 plane, has a radius of 0.1 meter and a resistance of 5 ohm.

Given, $\vec{B} = 0.20\sin 10^3 t\ \hat{a}_z$ Tesla, Determine the current carried by this loop. **(8)**

OR

(a) Explain the concept of scalar magnetic potential and magnetic vector potential. **(8)**

(b) Given that $\vec{H}_1 = -2\hat{a}_x + 6\hat{a}_y + 4\hat{a}_z$ Amp/m in region y – x – 2 ≤ 0 containing origin, where $\mu_1 = 5\mu_0$ Determine.

(i) $\vec{M}_1$ and $\vec{B}_2$

(ii) $\vec{H}_2$ and $\vec{B}_2$ in region y – x – 2 ≥ 0 where $\mu_2 = 2\mu_0$ **(4 × 4)**

UNIT – IV

(a) Write short note on reflection and refraction of uniform plane wave at oblique incidence from the surface of a dielectric. **(8)**

(b) Write short note on standing wave produced when a plane wave is incident normally on a perfect conductor. **(8)**

OR

(a) Derive poynting theorem and give interpretation of each term. **(8)**

(b) Dry ground has a conductivity of 5×10^{-5} mho/m and a relative dielectric constant of 10 at a frequency of 500MHz. Calculate the intrinsic impedance and reflection coefficient of the material of the ground.(Intrinsic impedance of free space is 377 ohm.) **(8)**

UNIT – V

Derive the general transmission line equation and prove that infinite line is equivalent to a finite line terminate its characteristic impedance. **(16)**

OR

(a) Show that the input impedance of a transmission line of length "ℓ" terminated by impedance "Z_R" is given by

$$Z_{in} = Z_0\left(\frac{Z_R\cosh pl + Z_0\sinh pl}{Z_0\cosh pl + Z_R\sinh pl}\right)$$

Where Z_0 and p are the secondary constants of the line. **(8)**

(b) A distortionless line has $Z_0 = 60$ ohm, $\alpha = 20$m Np/m, $\mu = 0.6c$, where c is speed of light in a vacuum. Find R, L, G, C and λ at 100 MHz. **(8)**

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