Printed Pages : 4 EEC303

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0324 Roll No.

B.Tech

(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10

ELECTROMAGNETIC FIELD THEORY

Time : 3 Hours] *[Total Marks : 100*

Note : *(1) Attempt **all** questions.*

*(2) All questions carry **equal** marks.*

1 Attempt any **four** parts of the following :

(a) Express vector $\overline{B} = \frac{10}{r} a_r + r \cos\theta \, a_\theta + a_\phi$ in cartesian coordinates.

(b) Given point $P(-2, 6, 3)$ and vector $\overline{A} = y a_x + (x+z) a_y$. Express P and $\overline{A}$ in spherical system.

(c) Explain the gradient of a scalar field.

(d) State and explain the divergence theorem.

(e) Given $\overline{A} = 5a_{\overline{x}} - 2\overline{a}_y + \overline{a}_z$, find the expression of a unit vector $\overline{B}$ such that $\overline{B} \parallel \overline{A}$.

(f) State and explain the Stokes theorem.

2 Attempt any **four** parts of the following :

(a) The cable shown in Fig. 1, is 10 km long. If $r_1 = 10$ mm, $r_2 = 15$ mm, $r_3 = 20$ mm, $\in r_1 = 2.0$, $\in r_2 = 4.0$. Find the capacitance of the cable.

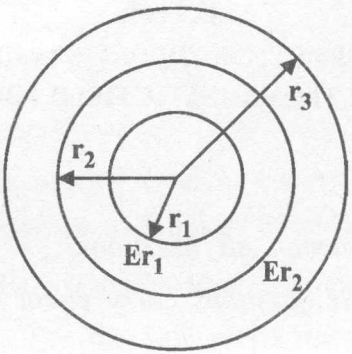

Fig. 1

(b) If the current density $J = \frac{1}{r^2}(\cos\theta a_r + \sin\theta a_\theta)$, A/m^2, find the current passing through a sphere radius of 1.0 m.

(c) If a potential $V = x^2yz + Ay^3z$, (i) find A so that Lapace's equation is satisfied (ii) with the value of A, determine electric field at (2, 1, –1)

(d) State and explain the poisson's and Laplace's equation.

(e) State and explain the coulomb's law.

(f) A sphere of volume 0.1 m^3 has a charge density of 8.0 pc/m^3. Find the electric field at a point (2, 0, 0) if the centre of the sphere is at (0, 0, 0).

3 Attempt any **two** parts of the following :

(a) State and explain the Biot-Savrat law. What is the magnetic field, H in cartesian coordinates due to Z-directed current element ? Find J if I = 2 A.

(b) State and explain the Stokes theorem. When vector magnetic potential is given by

$A = \frac{1}{r^3}(2.0 \cos\theta\, a_r + \sin\theta\, a_\theta)$, find the magnetic flux density.

(c) An isotropic material has a magnetic susceptibility of 3 and the magnetic flux density, $B = 10y a_x$ mwb/m^2. Determine μ, ρ_n, J, M and H. Define inductance, mutual inductance and coefficient of coupling.

4 Attempt any **two** parts of the following :

(a) State and explain the Maxwell's equation in differential and integral form. Also define the displacement currrent and depth of penetration.

(b) Derive the relation between $\bar{E}$ and $\bar{H}$ in uniform plane wave.

(c) Derive the expression for α and β in a conducting medium.

5 Attempt any **two** parts of the following :

(a) By using Smith chart, find the input impedance of $75\ \Omega$ lossless transmission line of length $0.1\ \lambda$. when the load is a short.

(b) The short circuit and open circuit impedance of 10 km long open wire transmission line are $Z_{sc} = 2930 \angle 26°$ and $Z_{oc} = 260 \angle -32°$ at a frequency of 1 kHz. Calculate the characteristics impedance and phase velocity.

(c) Define reflection loss, transmission loss and return loss. The $600\ \Omega$ lossless transmission line is feeded by $50\ \Omega$ generator. If the line is 200 meter long and termintated by load $500\ \Omega$. Determine in db (i) reflection loss (ii) Transmission loss (iii) return loss.
