



(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 $\vec{B} = \frac{10}{r} a_r + r \cos \theta a_\theta + a_\phi$ in cartesian coordinates.
- (b) Given point $P(-2, 6, 3)$ and vector $\vec{A} = y a_x + (x+z) a_y$. Express P and \vec{A} in spherical system.
- (c) Explain the gradient of a scalar field.
- (d) State and explain the divergence theorem.
- (e) Given $\vec{A} = 5a_x - 2a_y + a_z$, find the expression of a unit vector \vec{B} such that $\vec{B} \parallel \vec{A}$.
- (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, $\epsilon_{r1} = 2.0$, $\epsilon_{r2} = 4.0$. Find the capacitance of the cable.

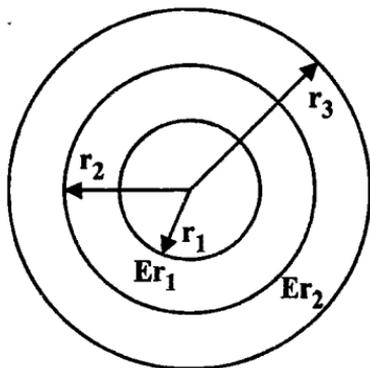


Fig. 1

- (b) If the current density $J = \frac{1}{r^2}(\cos\theta a_r + \sin\theta a_\theta)$, A/m², 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 Laplace'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 m³ has a charge density of 8.0 pc/m³. 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-Savart 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/m². 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 current 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 75Ω lossless transmission line of length 0.1λ . when the load is a short.
- (b) The short circuit and open circuit impedance of 10 km long open wire transmission line are $Z_{sc} = 2930 \angle 26^\circ$ and $Z_{oc} = 260 \angle -32^\circ$ at frequency of 1 kHz. Calculate the characteristics impedance and phase velocity.
- (c) Define reflection loss, transmission loss and return loss. The 600Ω lossless transmission line is feeded by 50Ω generator. If the line is 200 meter long and terminated by load 500Ω . Determine in db (i) reflection loss (ii) Transmission loss (iii) return loss.

