

Student Name: ..... Student ID: .....

Answer these questions as the best of your knowledge

**Q1)**

**(15 marks)**

- State Maxwell's equations for static EM fields?
- Find the maximum rate of change in scalar field:

$$W = 10 r \sin^2 \theta \cos \phi$$

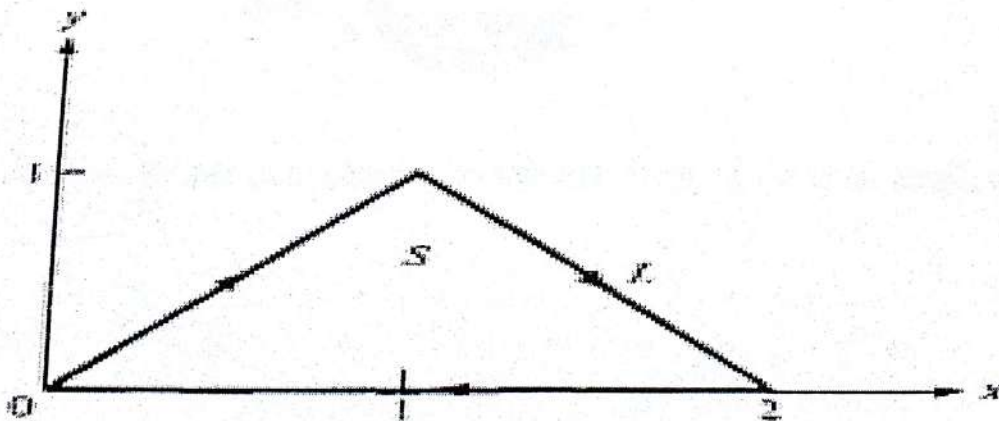
- What is the meaning of the vector if it is solenoidal? and potential?

**Q2)**

**(15 marks)**

Given that  $F = x^2 y a_x - y a_y$  Find:

- $\oint_L F \cdot dl$  where L is shown in Figure.
- $\int_S (\nabla \times F) \cdot dS$  where S is the area bounded by L.
- Is Stokes's theorem satisfied?



(15 marks)

**Q3)**

In a certain region, the electric field is given by

$$\mathbf{D} = 2\rho(z + 1)\cos\phi \mathbf{a}_\rho - \rho(z + 1)\sin\phi \mathbf{a}_\phi + \rho^2 \cos\phi \mathbf{a}_z \mu\text{C/m}^2$$

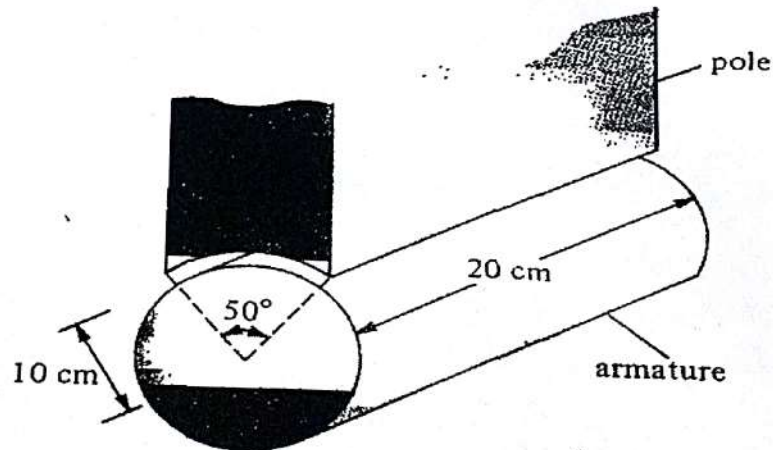
- Find the charge density.
- Calculate the total charge enclosed by the volume  $0 < \rho < 2$ ,  $0 < \phi < \pi/2$ ,  $0 < z < 4$ .
- Confirm Gauss's law by finding the net flux through the surface of the volume in (b).

**Q4)**

(15 marks)

The electric motor shown in Figure

$$\mathbf{H} = \frac{10^6}{\rho} \sin 2\phi \mathbf{a}_\rho \text{ A/m}$$



- Calculate the flux per pole passing through the air gap if the axial length of the pole is 20 cm.

(b) Determine  $\mathbf{J}$  at  $(1, 45, 0)$

(c) Determine  $\mathbf{B}$

**End of the questions**