HERIOT-WATT UNIVERSITY
DEPARTMENT OF COMPUTING AND ELECTRICAL ENGINEERING

22.3MB1 Electromagnetics

Tutorial 1

1. Determine the gradient of the following potential: $V = x^2 y + zy^2 + xyz$

[$\overrightarrow{\nabla V} = (2xy + yz)\vec{a}_x + (x^2 + 2yz + xz)\vec{a}_y + (y^2 + xy)\vec{a}_z$]

2. Determine the divergence of the following vector: $\vec{E} = y^2\vec{a}_x + z^2\vec{a}_y + x^2\vec{a}_z$

[$\nabla.E = 0$]

3. Determine the divergence of the following vector: $\vec{E} = x\ y\vec{a}_x + yz\ \vec{a}_y + zx\ \vec{a}_z$

[$\nabla.E = y + z + x$]

4. Calculate the curl of the following vector: $E = y^2\vec{a}_x + z^2\vec{a}_y + x^2\vec{a}_z$

[$\nabla x\vec{E} = -2(z\vec{a}_x + x\vec{a}_y + y\vec{a}_z)$]

5. Show that, in cartesian coordinates

$$\nabla \times \nabla \times \underline{A} = \nabla\nabla \cdot \underline{A} - \nabla^2 \underline{A}$$

6. Show that, in a charge free, current free dielectric, Maxwell's two divergence equations may be derived from the two curl equations so far as time-varying parts of the field are concerned.

7. Show that, if the equation for continuity of charge is assumed, the two divergence relations in Maxwell's equations may be derived from the curl equations so far as a-c components of the field are concerned, for regions with finite ρ and $\underline{J}$.

