Tutorials   Electromagnetic Theory
(Term: Aug to Dec 2019)

1. Given $\vec{D} = (2y^2z - 8xy)\hat{i} + (4xyz - 4x^2)\hat{j} + (2xy^2 - 4z)\hat{k}$. Determine the total charge within a volume 10^{-14} m^3 at P (1,-2,3), if the divergence of $\vec{D}$ gives the charge density ρ_v.

2. Given $\vec{D} = 9x^3\hat{i} + 5y^2\hat{j} + 2z\hat{k}$ Cm^{-2}. If the divergence of $\vec{D}$ represents the charge density ρ_v, find ρ_v at the point (1,5,9) m.

3. Given $\vec{D} = 4x\hat{i} + 3y^2\hat{j} + 2z^3\hat{k}$ Cm^{-3}. If the divergence of $\vec{D}$ represents the charge density ρ_v, then find the total charge in a volume defined by six planes for which $1 \le x \le 2, 2 \le y \le 3, 3 \le z \le 4$.

4. The magnetic field intensity is given in a certain region of space as
$$\vec{H} = \frac{x+2y}{z^2}\hat{j} + \frac{2}{z}\hat{k} \text{ Am}^{-1}.$$
Find the curl of the magnetic field.

5. A point charge, Q = 30nC is located at the origin in Cartesian system. Find the electric flux density and the electric field intensity at (1, 3,-4).

6. Suppose $A = x^2z^2\hat{i} - 2y^2z^2\hat{j} + xy^2z\hat{k}$. Find $\nabla \cdot A$ at the point P (1,-1, 1).

7. A parallel plate capacitor consists of plates of area 10 cm^{-2} with separation 10mm and dielectric medium of permittivity $\in = 4 \in_0$. Calculate the displacement current, if the voltage applied is 15 sin(1000t) and $\in = 4 \in_0$.

8. $\vec{A} = x^2yz\hat{i} + xy^2z\hat{j} + xyz^2\hat{k}$. Determine curl $\vec{A}$.

9. $\vec{A} = x\hat{i} + y\hat{j} + z\hat{k}$. Find div A and curl $\vec{A}$.

$$(\in_0 = 8.854 \times 10^{-12} Fm^{-1})$$