Answer key

Q.P. 22954

(1)

1. (a) $a = 4, \quad b = 2, \quad c = -1.$

2. (a) ~~Idl~~ Calculate $I\,dl$

Then unit vector $\bar{a}_{AB} = \frac{\overline{AB}}{AB}$

$$I\,dl = 6\times10^{-4}\,\bar{a}_{AB}$$

$$I\,dl = -0.413\bar{a}_x - 0.413\bar{a}_y - 0.138\bar{a}_z \quad (\mu A\cdot m)$$

$$d\bar{H} = \frac{I\,dl \times \bar{a}_{AC}}{4\pi (AC)^2}$$

$$d\bar{H} = 0.71\bar{a}_x - 0.83\bar{a}_y + 0.375\bar{a}_z \quad (\mu A/m)$$

3(a) $C_a = 553$ (pF)

$C_s = 1475$ (pF)

$$\frac{1}{C} = \frac{1}{C_a} + \frac{1}{C_s} \quad \text{or} \quad C = \frac{C_a C_s}{C_a + C_s} = 402 \text{ (pF)}$$

4(a) $\nabla \times \bar{E} = -j\omega\mu\bar{H}$

$$\bar{H} = \frac{-800}{j\omega\mu} e^{(4x-kt)} \bar{a}_z \quad (A/m)$$

②

4(a) $LHS = \oint \overline{D} \cdot d\overline{s} = 12 \, (C)$

$RHS = \int_v (\nabla \cdot \overline{D}) \, dv = 12 \, (C)$

$LHS = RHS$

Hence proved.

6(a) $\phi = -1.63 \, \mu C$

$E_1 = -30 \overline{a_x} - 180 \overline{a_y} - 1500 \overline{a_z}$ (V/m)

5(a) $|F_m| = 0.49 \, (mN)$

$0.47 \overline{a_x} + 0.1 \overline{a_y} - 0.19 \overline{a_z}$ (mN)

(b) $x = 4m, \; y = 12m$

$E_{n1} = \frac{11}{\sqrt{14}}$

$E_{t1} = -0.36 \overline{a_x} - 1.57 \overline{a_y} + 4.21 \overline{a_z}$

$E_{t2} = -0.36 \overline{a_x} - 1.57 \overline{a_y} + 4.21 \overline{a_z}$

$D_{n2} = D_{n1}$.