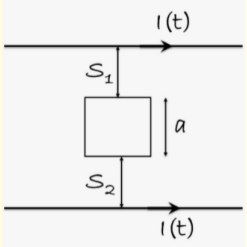
Ques1.

An interface at $z = 0$ separates two media labeled as 1 and 2. The ratio of the magnetic permeability of the two media μ_2/μ_1 is $5/4$. Assume, there is no free current at the interface. The magnetic field in medium 1 is given by $\vec{B}_1 = 4z\hat{x} + 5x\hat{z}$. This results in the magnetic field in medium 2 as $\vec{B}_2 = a\hat{x} + b\hat{y} + c\hat{z}$. The values of a, b and c are [5z], [0] and [5x], respectively.

Ques2.

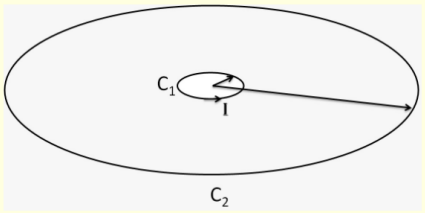
Two infinite parallel wires, each carrying current $I(t) = 2t$ in the same direction, are at distances $S_1 = a$ and $S_2 = 3a$ from the edges of a square loop with side-lengths a as shown in the figure (the image is not to scale). The square loop and the wires lie on the same plane. All quantities are in SI units. The induced emf (in the unit of $\frac{\mu_0 a}{2\pi}$) in the square loop is [0.8] in [anticlockwise] direction (observed from above the page). Round off the answer **to one decimal place** in the first answer box, and write only **clockwise** or **anticlockwise** in the second answer box.



Ques3.

The figure shows two coplanar, concentric circular rings C_1 and C_2 with radii R_1 and R_2, respectively. Given that $R_2 = 10R_1$ and $R_1 = 1$ mm. The flux through C_2, when a steady current $I = 1$ mA passes through C_1, can be calculated as $\phi = n \times 10^m$ Wb. Then the values of n and m are [2] and [-13], respectively, where n is a single digit integer.

[Given: The magnetic field at a point on the axis of a circular ring carrying steady current I at a distance z from the center of the ring is given by $B(z) = \frac{\mu_0 I}{2} \frac{R^2}{(R^2+z^2)^{3/2}}$, where R is the radius of the ring.]



Ques4.

A parallel plate capacitor is immersed in a liquid and is driven by a sinusoidal voltage with frequency 4×10^{10} Hz. Relative permittivity of the liquid is 100 at the same frequency; relative permeability $\mu_r \approx 1$ and the resistivity is $0.25\,\Omega$-cm. The ratio of the free current to the displacement current in the capacitor is [1.8].

Round off the answer **to one decimal place**.
