DPP – 1

SOLUTION

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1. $\phi = 8t^2 - 9t + 5, R = 20\Omega,$

$t = 0.25\text{ s}$

$e = \left|\frac{d\phi}{dt}\right| = 16t - 9; i = \frac{e}{R} = \frac{16t-9}{20}$

$i(t = 0.25\text{ s}) = \frac{(16 \times 0.25) - 9}{20} = \frac{-5}{20}$

$i = \frac{-5}{20} \times 1000\text{ mA} = -250\text{ mA}$

2. As, the loop is placed in $X - Y$ plane,

$\vec{B} = 3t^3\hat{j} + 3t^2\hat{k}$ or $\frac{d\vec{B}_z}{dt} = 6t$

Now, the induced emf,

$e = A\frac{dB_z}{dt} = \pi r^2(6t)$

At, $t = 2\text{ s}, \varepsilon = \pi(1)^2(6 \times 2) = 12\pi V$

On comparing with given value, we get $n = 12$

3. $\phi_B(t) = 10t^2 + 20t\text{mwb}$

$\because e = \frac{d\phi}{dt}$

$e = \frac{d}{dt}(10t^2 + 20t)$

$e = (20t + 20)\text{mV}$

at $t = 5$ seconds

$e = 120\text{mV}$

$i = \frac{e}{R} = \frac{120}{2} = 60$

$i = 60\text{ mA}$

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4. $e = -\frac{d\phi}{dt} = -\frac{BdA}{dt}$

$e = -B \times 2\pi r\left(\frac{dr}{dt}\right)$

$e = -2 \times 2 \times \frac{22}{7} \times (-2 \times 10^{-2} \times 10^{-3})$

$e = 8\pi \times 10^{-5}$Volt.

5. $e = -\frac{\Delta\phi}{t} = \frac{2NBA}{t}$

$i = \frac{e}{R}$ $q = it$

$q = \frac{2NBA}{R \cdot t} \cdot t$

$q = \frac{2NBA}{R}$

$\left[\frac{e}{q} = \frac{R}{t}\right]$

6. $\phi = \vec{B} \cdot \vec{A} = 4 + 12 = 16\omega b.$

7. (A) ACω (B) Cω (C) Coil I − ACW, Coil 2 − Cw

8. $e = -\frac{d\phi}{dt}$ $e \propto \frac{1}{dt}$

$i \propto \frac{1}{dt}$

$q \propto dt^0$

9. Induced voltage will be with top as negative and bottom as positive

10. Here, $B = B_0 e^{-\frac{t}{\tau}}$

Area of the circular loop, $A = \pi r^2$ Flux linked with the loop at any time, t, $\phi = BA = \pi r^2 B_0 e^{-\frac{t}{\tau}}$

Emf induced in the loop,

$e = -\frac{d\phi}{dt} = \pi r^2 B_0 \frac{1}{\tau} e^{-\frac{t}{\tau}}$

Net heat generated in the loop

$= \int_0^\infty \frac{e^2}{R} dt = \frac{\pi^2 r^4 B_0^2}{\tau^2 R} \int_0^\infty e^{-\frac{2t}{\tau}} dt$

$= \frac{\pi^2 r^4 B_0^2}{\tau^2 R} \times \frac{1}{\left(-\frac{2}{\tau}\right)} \times \left[e^{-\frac{2t}{\tau}}\right]_0^\infty$

$= \frac{-\pi^2 r^4 B_0^2}{2\tau^2 R} \times \tau(0 - 1) = \frac{\pi^2 r^4 B_0^2}{2\tau R}$