(1) Data :

$l = 2\pi r = 88 \times 10^{-2}$ m

$B_1 = 2.5$ T

$dt = 0.5$ s

$B_2 = 3$ T

Solution

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

$$= \frac{d(BA)}{dt}$$

$$= \frac{B_1 A_1 - B_2 A_2}{dt} \quad \text{— (A)}$$

Given $l = 2\pi r = 88 \times 10^{-2}$

$\therefore r = \frac{88 \times 10^{-2}}{2\pi}$

$\therefore A_1 = \pi r^2 = \pi \left(\frac{88 \times 10^{-2}}{2\pi}\right)^2$

$= 44^2 \times 10^{-4}/\pi \ m^2$

& $4L = 88 \times 10^{-2}$

$\therefore L = 22 \times 10^{-2}$ m

$\therefore A_2 = L^2 = 22^2 \times 10^{-4} \ m^2$

Subst. in (A)

$$\therefore |e| = \frac{\left[2.5\left(44^2 \times 10^{-4}/\pi\right) - 3\left(22^2 \times 10^{-4}\right)\right]}{0.5}$$

$\therefore |e| = 0.0178$ V

(2) Data :

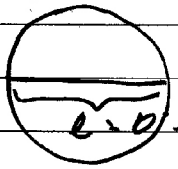
$n = 10$

$l = 0.5$ m

$v = 18 \times \frac{5}{18} = 5$ m/s

$B = 3.6 \times 10^{-5}$ T

(i) $e = ?$



$\therefore l' = \frac{0.5}{2} = 0.25$ m

$\therefore e = Bl'v$

$= 3.6 \times 10^{-5} \times 0.25 \times 5$

$= 4.5 \times 10^{-5}$ V

(ii) Same as each spoke is // to each other & // configuration the voltage is the same.

(3) Data :

$n_p = 40$

$V_p = 100$ V

$P_s = 100$ W

$n_s = ?$

$V_s = 400$ V

$I_p = ?$

$I_s = ?$

Solution

$\frac{V_p}{V_s} = \frac{n_p}{n_s}$

$\frac{100}{400} = \frac{40}{n_s}$

$\therefore n_s = \frac{40 \times 400}{100}$

$= 160$

$\frac{I_p}{I_s} = \frac{n_s}{n_p}$

$\therefore \frac{I_p}{I_s} = \frac{160}{40}$

$\therefore \frac{I_p}{I_s} = 4$ —(i)

$\frac{V_p}{V_s} = \frac{I_s}{I_p}$

$P = V_p \cdot I_p$

$100 = 100 \cdot I_p$

$\therefore I_p = 1\ A$

$P = V_s \cdot I_s$

$100 = 400 \cdot I_s$

$\therefore I_s = 0.25\ A$

(4) Data :

$R = 0.1\ \Omega$

$\phi = 6t^2 + 7t + 1$ mWb

$e|_{t=1} = ?$

$I = ?$

Solution :

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

$= \frac{d}{dt}(6t^2 + 7t + 1)$

$= 6(2t) + 7$

$= 12t + 7$

$e|_{t=1} = 12(1) + 7$

$= 19$ mV

$I = \frac{e}{R} = \frac{19}{0.1} = 190$ mA

(5) Data :

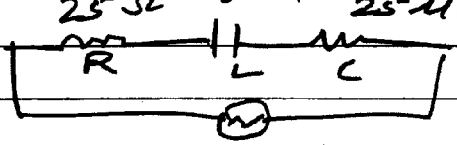
$C = 25\ \mu F$

$L = 0.1\ H$

$R = 25\ \Omega$

$e = 310 \sin(314t)$

Solution :



$e = 310 \sin(314t)$

(i) $e = 310 \sin(314t)$

Comparing with

$e = e_0 \sin(2\pi f t)$

$e_0 = 310$

$2\pi f = 314$

$\therefore f = 50\ Hz$

$X_L = 2\pi f L$

$= 314\ (0.1)$

$= 31.4\ \Omega$

$X_C = \frac{1}{2\pi f C}$

$= \frac{1}{314 \times 25 \times 10^{-6}}$

$= 127.3\ \Omega$

(ii) $Z = \sqrt{R^2 + (X_L - X_C)^2}$

$= \sqrt{25^2 + (31.4 - 127.3)^2}$

$= 99.1\ \Omega$

$i_0 = \frac{e_0}{Z} = \frac{310}{99.1} = 3.13\ A$

$\therefore i = \frac{i_0}{\sqrt{2}} = 2.21\ A$

(iii)

$\tan\phi = \frac{|X_L - X_C|}{R}$

$= \frac{|31.4 - 127.31|}{25}$

$= 3.836$

$\therefore \phi = 75^\circ 23'$

(iv) $i = i_0 \sin(2\pi f t + \phi)$

$\therefore i = 3.13 \sin(314t + 75^\circ 23')$

Note: Since $X_C > X_L$

$\therefore$ its capacitive

$\therefore i$ leads voltage.

(6) Data:

$i_p = 10\ A$

$i_{pf} = 0\ A$

$dt = 0.1\ s$

$M = 3\ H$

$e_s = ?$

$n_s = 50$

$d\phi$ per turn $= ?$

Solution :

$$|e_s| = M\frac{di_p}{dt}$$

$$= 3\left(\frac{10-0}{0.1}\right)$$

$$= 300\ V$$

$$|e_s| = \frac{d\phi_s}{dt}$$

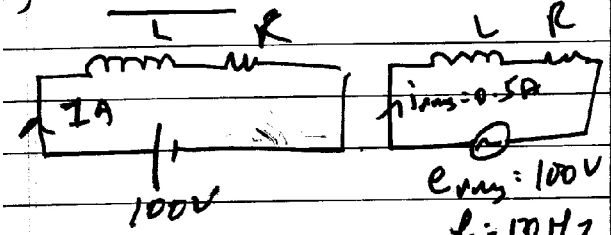
$$300 = \frac{d\phi_s}{0.1}$$

$$\therefore d\phi_s = 30\ Wb$$

$$d\phi_s \text{ per turn} = \frac{30}{50}$$

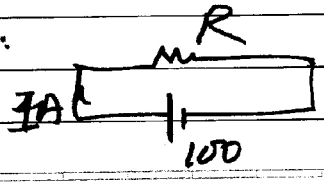
$$= 0.6\ Wb.$$

b) Data



NOTE $X_L = 2\pi fL$
& DC $f = 0$
$\therefore X_L = 0$

$\therefore$ DC :



$$\therefore R = \frac{V}{I} = \frac{100}{1} = 100\ \Omega$$

For AC :

$$V_R = I \cdot R$$

$$= 0.5 \times 100$$

$$= 50\ V$$

NOT REQD

$$Z = \frac{e}{i} = \frac{100}{0.5} = 200\ \Omega$$

$$Z = \sqrt{X_L^2 + R^2}$$

$$\therefore 200 = \sqrt{X_L^2 + 100^2}$$

$$40000 = X_L^2 + 10000$$

$$30000 = X_L^2$$

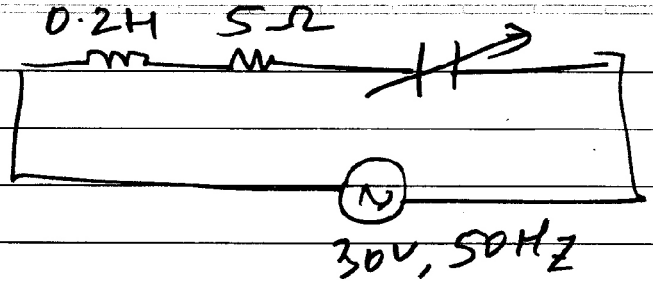
$$\therefore X_L = \sqrt{30,000}$$

$$2\pi fL = \sqrt{30000}$$

$$2\pi \times 50 \times L = 173.2$$

$$\therefore L = 0.55\ H$$

(8)



$$f = \frac{1}{2\pi\sqrt{LC}}$$

$$\therefore C = \frac{1}{4\pi^2 f^2 L}$$

$$C = \frac{1}{4\times(3.14)^2\times(50)^2\times 0.2}$$

$$= 50.7\ \mu F$$

$$i = \frac{e}{R} = \frac{30}{5} = 6A$$

** NOTE : At Resonance $Z = R$