(201) (a)

I. $\mathcal{E}_1 = d\phi/dt = \frac{0.4-0}{3} = 0.1333\ \text{wb/s}$

$e = -N\frac{d\phi}{dt}$ assuming $N = 1$

$e_1 = -0.1333V$

$\mathcal{E}_2 = -N\frac{d\phi}{dt} = -1\cdot\left[\frac{0.4-0.4}{3}\right) = 0V$

$\mathcal{E}_3 = -N\frac{d\phi}{dt} = -1\cdot\left[\frac{0.2-0.4}{3}\right) = -1\frac{(-0.2)}{3} = 0.067V$

(b) $R = 0.50\Omega$ $\quad I = V/R$

$I_1 = -0.1333/0.50 = -0.2666A$

$I_3 = 0.067/0.50 = 0.134\ A$

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(23)

3. $B = 4.9 \times 10^{-5}$ T

$v = 22$ m/s

$l = 2.1$ m

a) $\Rightarrow e = vBl = 22 \times 2.1 \times 4.9 \times 10^{-5}$

$= 2.264$ mV

b) Drivers side

2014

4) $V = 0.29 \, m/s$

$D = 5.6 \times 10^{-3} \, m$

$B = 0.67 \, T$

$$e = VBl = 0.29 \times 5.6 \times 10^{-3} \times 0.67$$
$$= 1.1 \, mV$$

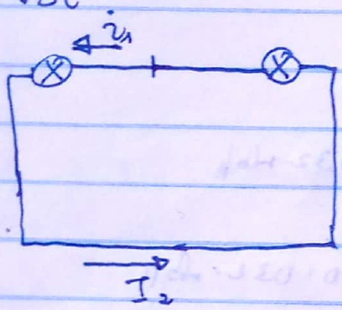
2015

5. $R_1 = 365 \, \Omega$

$R_2 = 730 \, \Omega$

$E_1 = VBl$ $\qquad\qquad V = \frac{\Delta x}{\Delta t}$

$E_2 = VBl$



$i_1 = i_2$,

a) $V_1 = iR_1$ $\quad \frac{E_2}{E_1} \quad \frac{V_2}{V_1} = \frac{i_2 R_2}{i_1 R_1} = \frac{R_2}{R_1} = \frac{730}{365} = 2.$

$V_2 = i_2 R_2$

$$\frac{E_1}{E_2} = \frac{1}{2}$$

b) $\frac{I_1}{I_2} = 1$ coz the connection is in series

V^2/R

$\frac{4V^2B^2l^2/365}{V^2B^2l^2/730}$

$\frac{4}{365} \times 730 = 8$

(c) $E_1 = 2VBl$

$E_2 = VBl$

$P_1 = 2VBL \times i$

$P_2 = VBl \times i$

$$P_1/P_2 = \frac{2VBl \times i}{VBl \times i} = \frac{V_1^2/R_1}{V_2^2/R_2} = \frac{4V^2B^2l^2/365}{V^2B^2l^2/730}$$

$$= \frac{4}{365} \times 730 = 8$$

$$P_1/P_2 = 8$$

$\Phi = BA$

(206) $\theta = 44°$

$\Phi_{xy} = BA\cos\theta =$

$= BA\cos 44 = 0.719\,B$

Φ_{xz} = zero since this plane is perpendicular to zy

Φ_{xy} = zero " " "

$\Phi_{xz} / \Phi_{xy} = 0/0 = 0$

(207) $R = 0.17\,m$

$B = 0.70\,T$

$\Phi = BA\cos\theta$

$\Phi_i = 0.7 \times \frac{\pi}{2}(0.17^2) \times \cos 0 = 0.032\,wb/s$

$\Phi_f = 0.7 \times \pi/_2 \times 0.17^2 \times \cos 180 = -0.032\,wb/s$

$\Delta\Phi = \Phi_f - \Phi_i = -0.032 - 0.032 = -0.064\,wb/s$

(209) $A = 0.024\,m^2$

$B = 2.5\,T$

$e = 0.010\,V$

$\Phi = BA = 2.5 \times 0.024 = 0.06\,wb/s$

$e = \frac{d\Phi}{dt} = \frac{0 - 0.06}{t}$

$0.010 = -\frac{0.06}{t}$

$t = \frac{-0.06}{0.01} = 6s$

(2011) $N = 111$ turns

radius $= 3.88 \times 10^{-2}\,m$ $\Rightarrow A = \pi r^2 = \pi \times (3.88 \times 10^{-2})^2$

$R = 0.488\,\Omega$ $= 4.73 \times 10^{-3}\,m^2$

$\Delta B / \Delta T = 0.830\,T/s$

$\frac{\Delta\Phi}{\Delta T} = \frac{\Delta B}{\Delta T} \times A = 4.73 \times 10^{-3} \times 0.830$

$= 3.92 \times 10^{-3}\,wb/s$

$f = Ni = BA?$

$e = N\frac{d\phi}{dt} = 111 \times 3.93 \times 10^{-3} = 0.4357$ ✓

$I = e/R = 0.4357/0.488 = 0.893A$

$\cancel{1/t}$ $\phi = BA\cos\theta$

$= 3.92 \times 10^{-2}$ wb/s

(2022) Rating 9 V

2022 current $= 203$ mA

wall voltage $= 120$ V

$\frac{N_2}{N_1} = \frac{9}{120}$

Power input = p input assuming it is ideal transformer

$9 \times 203 \times 10^{-3} = 120\, i$

$i = \frac{9 \times 203 \times 10^{-3}}{120} = 15.225$ mA

Power by wall outlet $= 15.225 \times 10^{-3} \times 120 = 1.827$ W

Power by charger $= 9 \times 203 \times 10^{-3} = 1.827$ W

(2013). RTL, induced current moves in direction opposite current producing it (Lenz's Law)

(208). $\phi = 5.3 \times 10^{-3}$ wb

Area of square $= l^2$, perimeter $= 4l$

$4l = 2\pi D$

$D = \frac{4l}{2\pi}$

Area of circle $= \frac{\pi}{4} D^2 = \frac{\pi}{4} \times \left(\frac{4L}{2\pi}\right)^2$

$= \frac{\pi}{4} \times \frac{16L^2}{4\pi^2} = \frac{L^2}{\pi}$

$\phi = BA$

$\phi_{sq} = B(L^2)$

$\phi_{circle} = B\left(\frac{L^2}{\pi}\right) = \frac{L^2}{\pi} B$ $\therefore \phi_{circle} = \frac{\phi_{sq}}{\pi} = \frac{5.3 \times 10^{-3}}{\pi} = 1.687 \times 10^{-3}$ wb

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(2024) a) When current in the loop is antclockwise

(b) To produce a positive current the current in the wire must be negative

(2018) $H = 2.0\,mH$

a) $0-2.0ms$ $\frac{dI}{dt} = \frac{4-0}{2-0} = 2A/s$

$V = L\,dI/dt = 2.0\times10^{-3} \times 2 = 4mV.$

(b) $2.0-5.0ms$

$dI/dt = 0 = \frac{4-4}{5-2} = 0/3 = 0.$

$V = 0$

c) $5.0-9.0ms$

$\frac{dI}{dt} = \frac{0-4.0}{4} = -1A/s$

$V = L\,dI/dt = 2\times10^{-3}\times -1 = -2mV$

(2017) $r = 0.17m$, $l = 5.8m$

$B = 0.15T$

$\omega = 24\,rad/s$

$V = \omega r = 24\times0.17 = 4.08m/s$

$e = VBl$

$= 4.08 \times 0.15\times5.8 = 3.5496\,V.$

$= 3.5496V.$

Peak $= \pm\, 3.5496V.$

(2019) $t = 81ms$ } Time interval

$I_2 = 6.9mA$ $R_2 = 12\Omega$

$V_2 = I_2R_2 = 6.9\times10^{-3}\times 12 = 82.8\,mV$

$M = 3.2mH$

$M = \frac{\text{flux linkage in coil A}}{\text{current in coil B}}$ ⇒ Flux in A $= 3.2\times10^{-3}\times6.9\times10^{-3}$

$= 2.208\times10^{-5}\,Wb$

Mutually induced voltage in secondary coil $e_m = -M \frac{di_1}{dt}$

$$\frac{di_1}{dt} = \frac{e_m}{-M} = \frac{-82.8 \times 10^{-3}}{3.2 \times 10^{-3}} = -25.875 \text{ A/s}$$

(2020) coil 1 N_1 turns

R_1 radius

N_2 turns

R_2 radius

$$\phi_1 = \frac{N_2 I_1}{l/\mu_0\mu_r A} \quad \text{flux/ampere} = \frac{\phi_1}{I_1} = \frac{N_1}{l/\mu_0\mu_r A}$$

Assuming whole of this flux is linked with the other coil having N_2 turns, weber-turns, it due to the flux/ampere in the first coil is given by

$$M = \frac{N_2 \phi_1}{I_1} = \frac{N_2 N_1}{l/\mu_0\mu_r A} \quad \therefore M = \frac{\mu_0\mu_r A N_1 N_2}{l}$$

$$M = \frac{N_1 N_2}{l/\mu_0\mu_r A} = \frac{N_1 N_2}{l/\mu_0\mu_r \pi R_1^2}$$

$$M = \frac{N_2 \phi_1}{I_1}$$

$$B = \mu_0 H \times \mu_r N_1 I_1 / L$$

$$A_1 = \pi R_1^2$$

$$\phi = BA_1 = \mu_0^2 \times N_1 I_1 H / L \times \pi R_1^2$$

$$M = \frac{N_2 \cdot \mu_0^2 \mu_r \times N_1 \cdot I_1 H \times \pi R_1^2}{I_1 l} = \frac{N_2 N_1 \times \mu_0\mu_r H \pi R_1^2}{l}$$

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(2021) $\cancel{\frac{N_2}{N_1}} = \frac{1}{40}$

$$\frac{N_2}{N_1} = \frac{1}{40}$$

$$120V = V_1$$

$$\frac{N_2}{N_1} = \frac{V_2}{V_1} = \frac{1}{40}$$

$$\frac{V_2}{V_1} = \frac{1}{40} =$$

$$V_2 = \frac{V_1}{40} = \frac{120}{40} = 3V$$

(2023) $\cancel{\frac{N_1}{N_2} = \frac{29}{1}}$

$$\frac{N_1}{N_2} = \frac{29}{1}$$

$$V_1 I_1 = V_2 I_2$$

$$\frac{I_1}{I_2} = \frac{V_2}{V_1} = \frac{N_2}{N_1} = \frac{1}{29}$$

$$I_1 = 41.9mA$$

$$\frac{I_1}{I_2} = \frac{1}{29}$$

$$I_2 = \frac{I_1}{29} = \frac{41.9}{29} = 1.445 mA$$

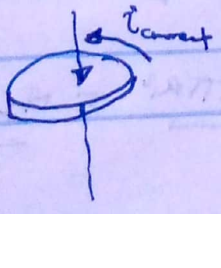
Second Transformer $\Rightarrow I_1 = 1.445mA$

$$I_2 = \frac{I_1}{32} = \frac{1.445}{32} = 0.045 mA$$

$$P = Vi = 240 \times 0.045 = 10.84 watts$$

(2024)

2022. In a, when the magnet is above the ring, the magnetic field is increasing and pointing down as the magnet falls towards the ring. This increase in magnetic field strength means an increase in magnetic flux, so the induced current goes counterclockwise and produces a magnetic field going up. This makes the ring produce a North pole at the top and like poles repel and thus it will cause retardation



When the magnet is below the ring, the field is getting weaker and still pointing down when it falls so the decreasing field strength means a decreasing magnetic flux, so that the induced current will now want to create a field in the same direction, so pointing down. Induced current will go clockwise. Now the ring has a North pole which attracts the south pole of the magnet causing retardation

(b) The ring is not continuous, so you can not set up current and thus no induced magnetic field, therefore no retardation