സഹായി

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2 - MAGNETIC CIRCUITS

$F = NI$

$H = F/l$

$B = \phi/A$

$B/H = \mu_0 \mu_r = \mu$

$S = F/\phi = \frac{l}{\mu_0 \mu_r A}$

MMF = Magnetic motive force

μ_0 = permeability of free space

μ_r = Relative permeability of medium (air = 1)

1) A mild steel ring has a mean diameter of 16 cm and a cross-sectional area of $4\,cm^2$. Calculate the ampere turns to produce a flux of $400\,\mu wb$ in the ring if the relative permeability of the material is 1000. Also find the reluctance of the ring.

$D = 16\,cm = 16 \times 10^{-2}\,m$

$A = 4\,cm^2 = 4 \times 10^{-4}\,m$

$F = ?$

$\phi = 400\,\mu wb = 400 \times 10^{-6}\,wb$

$\mu_r = 1000$

$S = \frac{l}{\mu_0 \mu_r A} = \frac{\pi d}{\mu_0 \mu_r A} = \frac{3.14 \times \cancel{16}^{4} \times 10^{-2}}{\cancel{4\pi} \times 10^{-7} \times 1000 \times 4 \times 10^{-4}}$

4×3.14

$$= \frac{4\times10^{-2}}{1\times10^{-7}\times1000\times4\times10^{-4}} = \frac{10^2}{10^{-4}} = 10^6 \; AT/Wb$$

$S = F/\phi$

$F = S\phi$

$F = 10^6 \times 400\times10^{-6} = 400 \; AT$

2) An iron ring of mean length 100 cm and a cross sectional area of 6 cm² is wound with 200 turns of wire. Calculate the current required to produce a flux of 0.6 mWb in the ring, if the relative permeability of iron is 2000. If now a radial cut of 2mm is made in the iron ring, find the new value of the current required to produce the same flux in the air gap. Neglect fringing and leakage flux.

$l = 100 \text{ cm} = 100\times10^{-2} \text{ m}$

$A = 6 \text{ cm}^2 = 6\times10^{-4} \text{ m}^2$

$N = 200$

$\phi = 0.6 \text{ mWb} = 0.6\times10^{-3} \text{ Wb}$

$\mu_r = 2000$

$$S = \frac{l}{\mu_0\mu_r A} = \frac{100\times10^{-2}}{4\pi\times10^{-7}\times2000\times6\times10^{-4}} = 6.63\times10^5 \; A/Wb$$

$S = F/\phi$

$F = S\times\phi = 6.63\times10^5\times0.6\times10^{-3} = 397.8 \; A$

$F = N\cdot I \qquad I = F/N = \frac{397.8}{200} = \cancel{1.989 A} = 1.99 \; A$

$S = S_{iron} + S_{air\ gap}$

$S = \dfrac{100\,cm - 2\,mm}{\mu_0 \mu_r A} + \dfrac{2 \times 10^{-3}}{4\pi \times 10^{-7} \times 1 \times A}$

$S = \dfrac{100 \times 10^{-2} - 2 \times 10^{-3}}{4\pi \times 10^{-7} \times 2000 \times 6 \times 10^{-4}} + \dfrac{2 \times 10^{-3}}{4\pi \times 10^{-7} \times 1 \times 6 \times 10^{-4}}$

$= 6.62 \times 10^{5} + 2.65 \times 10^{6} = \underline{3.312 \times 10^{6}\ A/wb}$

$F = S \times \phi = 3.312 \times 10^{6} \times 0.6 \times 10^{-3} = \underline{1987.2\ A}$

$I = F/N = \dfrac{1987.2}{200} = \underline{9.936\ A}$

3) A mild steel ring of 30 cm mean circumference has a cross section area of 6 cm^2 and has a winding of 500 turns on it. The ring is cut through at a point so as to provide an air gap of 1mm in the magnetic circuit. It is found that the current of 4 A in the winding produces a flux density of 1 tesla in the air gap. Find

(i) the relative permeability of the mild steel.

(ii) Inductance of the winding.

Ans: $l = 30\,cm = 30 \times 10^{-2}\,m$

$A = 6\,cm^2 = 6 \times 10^{-4}\,m^2$

$N = 500$

Airgap length $= 1\,mm$

$I = 4\,A$

$B = 1\,T$

$S = S_{ring} + S_{airgap}$

$$= \frac{30\times10^{-2} - 1\times10^{-3}}{4\pi\times10^{-7}\times\mu_r\times6\times10^{-4}} + \frac{1\times10^{-3}}{4\pi\times10^{-7}\times1\times6\times10^{-4}}$$

$S = F/\phi$

$\phi = BA = 6\times10^{-4}$ wb

$F = NI = 500\times\cancel{30\times10^{-2}}\ \cancel{150\ A}\ 2000\ A$

$$S = \frac{2000}{6\times10^{-4}} = \cancel{25\times10^{4}} = \cancel{333\times10^{4}}\ 3.33\times10^{6}\ A/wb$$

$$3.33\times10^{6} = \frac{\overset{2.99\times10^{-1}}{\cancel{30\times10^{-2} - 1\times10^{-3}}}}{\underset{7.536\times10^{-10}\times\mu_r}{\cancel{4\pi\times10^{-7}\times\mu_r\times6\times10^{-4}}}} + \frac{10^{-3}}{7.536\times10^{-10}}\quad 1.326\times10^{6}$$

$$2.004\times10^{6} = \frac{2.99\times10^{-1}}{7.536\times10^{-10}\times\mu_r}$$

$1.51\times10^{-3}\ \mu_r = 2.99\times10^{-1}$

$\mu_r = 1.98\times10^{2} = \cancel{1.92}\ 197.58$

$$L = N^2/S = \frac{500^2}{3.33\times10^{6}} = 7.5\times10^{-2}\ \frac{wb}{AT}$$

4) A iron ~~...~~ ring of mean diameter of 100 cm and a cross sectional area of 6 cm^2 is bound with 200 turns of wire. Calculate the current required to produce a flux of 0.6 mwb in the ring if the relative permeability of iron

is 2000. If now a radial cut of 2 mm is made in the iron ring. Find the new value of current required to produce the same flux in the air gap?

5) An ~~hair cor~~, ~~iron~~ ~~rod~~ air core toroid has 900 turns which are closely wounded. The mean radius of torroid is 25 cm and the diameter of each turn is 4 cm when current of 9 A flows through the coil. Find the mmf of coil, reluctance, flux produced and flux density.

$N = 900$

$r = 25cm$

$dia = 4cm$

$I = 9A$

$a = \frac{\pi d^2}{4}$

$mmf = NI$

$S = \frac{F}{\Phi} = \frac{l}{\mu_0 \mu_r A}$

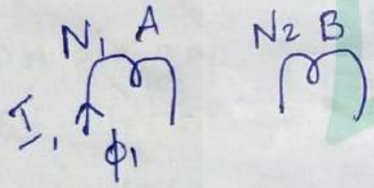
$S = \frac{F}{\Phi}$ $\quad B = \frac{\Phi}{A}$

1) ~~$d = 100 \text{ cm} = 100 \times 10^{-2} m$~~

~~$A = 6 \text{ cm}^2 = 6 \times$~~

Coefficient of Coupling

$$M = \frac{N_2 \phi_2}{I_1} = \frac{N_1 \phi_1}{I_2}$$



$$\phi_2 = K\phi_1$$

$$M = \frac{N_2 K \phi_1}{I_1} \quad -①$$

$$\phi_1 = K\phi_2$$

$$M = \frac{N_1 K \phi_2}{I_2} \quad -②$$

$$K_1 = K_2 = K$$

$$M^2 = \frac{N_2 K_1 \phi_1}{I_1} \times \frac{N_1 K_2 \phi_2}{I_2}$$

$$M^2 = K^2 \frac{N_1 \phi_1}{I_1} \frac{N_2 \phi_2}{I_2}$$

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$$M^2 = K^2 L_1 L_2$$

$$K^2 = \frac{M^2}{L_1 L_2}$$

$$K = \frac{M}{\sqrt{L_1 L_2}}$$

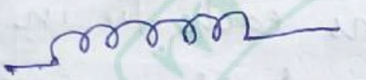
M = Mutual inductance

L_1 = self inductance of coil 1

L_2 = self inductance of coil 2

K = Coefficient of coupling.

Self Inductance of Solenoid



$$S = F/\phi$$

$$\phi = F/_S = \frac{NI}{l/\mu_0 \mu_r A}$$

$$L = \frac{N\phi}{I}$$

$$\phi = \frac{LI}{N}$$

$$\frac{NI}{l}(\mu_0 \mu_r A) = \frac{LI}{N}$$

$$\frac{N^2}{\frac{l}{\mu_0 \mu_r A}} = L \qquad L = \frac{N^2}{S}$$

1. A 50 cm long conductor moves with a velocity of 2 m/s at right angle to itself and a uniform magnetic

field of 1 wb/m² flux density. Calculate the voltage induced b/w the ends of the conductor. What will be the voltage if the conductor at 30° from the direction of flux.

$l = 50\text{ cm} = 50 \times 10^{-2}\text{ m}$

$v = 2\text{ m/s}$

$B = 1\text{ wb/m}^2 \quad \theta = 30^\circ$

$e = Blv\sin\theta = 1 \times 50 \times 10^{-2} \times 2 \cdot \sin 30$

$e = 100 \times 10^{-2} \cdot \frac{1}{2} = 0.5\text{ V}$

$(\theta = 90^\circ)$

$e = Blv\sin\theta = 1 \times 50 \times 10^{-2} \times 2 \cdot \sin 90$

$e = 100 \times 10^{-2} \cdot 1 = 1\text{V}$

2) Two identical coils of 400 turns each lie in parallel plane and produce the flux of 0.04 wb if current of 8 A is flowing in one coil. Find out the mutual inductance b/w coils.

$\cancel{M = K\sqrt{L_1 L_2}} \qquad M = \frac{N_1 \phi}{I_2}$

$M = \frac{400 \times 0.04}{8} = 2\text{ Henry}$

Home work questions

4) $d = 100\text{ cm} = 100 \times 10^{-2}\text{ m}$

$A = 6\text{ cm}^2 = 6 \times 10^{-4}\text{ m}^2$

$N = 200$

$I = ?$

$\phi = 0.6 \times 10^{-3}$ wb

$\mu_r = 2000$

$$S = \frac{l}{\mu_0 \mu_r A} = \frac{\pi \times 100 \times 10^{-2}}{4\pi \times 10^{-7} \times 2000 \times 6 \times 10^{-4}} = 2.083 \times 10^{6} \text{ A/wb}$$

$S = F/\phi$

$F = S\phi = 2.083 \times 10^{6} \times 0.6 \times 10^{-3} = 1.249 \times 10^{3}$ A

$F = NI$

$$I = F/N = \frac{1.249 \times 10^{3}}{200} = 6.245 \text{ A}$$

$S = S_{\text{iron ring}} + S_{\text{air gap}}$

$\cancel{S_{iron} = \frac{l}{\mu_0 \mu_r A}}$

~~Mean length of iron ring~~ $\cancel{= \pi \times 100 \times 10^{-2} = 3.14 \times 100 \times 10^{-2}}$

length of iron ring after radial cut $= (\pi \times 100 \times 10^{-2}) - (2 \times 10^{-3})$

$= 3.138$ m

$$S_{\text{iron ring}} = \frac{3.138}{4\pi \times 10^{-7} \times 2000 \times 6 \times 10^{-4}} = 2.082 \times 10^{6} \text{ A/wb}$$

$$S_{\text{airgap}} = \frac{2 \times 10^{-3}}{4\pi \times 10^{-7} \times 1 \times 6 \times 10^{-4}} = 2.65 \times 10^{6} \text{ A/wb}$$

$S = 2.082 \times 10^{6} + 2.65 \times 10^{6} = 4.732 \times 10^{6}$ A/wb

$S = F/\phi$

$F = S\phi = 4.732 \times 10^{6} \times 0.6 \times 10^{-3} = 2.839 \times 10^{3}$ A

$I = F/N = 2.839 \times 10^{3} = 1.419 \times 10^{1}$ A

$F = ?$

$S = ?$

$\phi = ?$

$B = ?$

$F = N \times I = 900 \times 9 = \underline{\underline{8100\ A}}$

length, $l = 2\pi r = 2 \times 3.14 \times 25 \times 10^{-2} = \underline{\underline{1.57\ m}}$

? A coil of 200 turns carries a current of 4 A. The magnetic flux linkage with the coil is 0.02 wb. Calculate the inductance of the coil if the current is uniformly reversed in 0.02 s. Calculate the induced emf in the coil.?

$N = 200$

$I = 4\ A$

$\phi = 0.02\ wb$

$L = \frac{N\phi}{I} = \frac{200 \times 0.02}{4} = 1\ H$

$dI = 4 - (-4) = 8$

$e = L\frac{dI}{dt} = 1 \times \frac{8}{0.02} = \underline{\underline{400\ V}}$

? Two identical coils P and S having 500 turns lie in ... Current in coil P changing at the rate ...

500 A per second induces emf of 12 V in coil S. Calculate the mutual inductance b/w the two coils if the self inductance of each coil is 50 mH Calculate the flux produced in coil P per ampere of current and coefficient of coupling b/w the two coils. $N = 500$ $\frac{dI_1}{dt} = 500$ $e_2 = 12\,V$

Ans. $M = \frac{e_2}{dI_1/dt} = \frac{12}{500} = \underline{\underline{0.024\ H}}$

$\cancel{L = \frac{N\phi}{I}}$ $\quad M = K\sqrt{L_1 L_2}$

$\cancel{N\phi = LI}$

$K = \frac{M}{\sqrt{L_1 L_2}} = \frac{0.024}{\sqrt{50\times10^{-3} \times 50\times10^{-3}}} = \underline{\underline{0.48}}$

$\cancel{\frac{d\phi}{dt} = \frac{dI}{dt}}$ $\quad L_1 = \frac{N\phi_1}{I_1}$

$\cancel{\frac{d\phi}{dI}} = \frac{\phi}{I_1} = \frac{L_1}{N_1} = \frac{50\times10^{-3}}{500} = \underline{\underline{1\times10^{-4}\ wb/A}}$

? A air solenoid has 300 turns. It's length is 25 cm and cross sectional area 3 cm^2. Calculate it's self inductance. If the coil current of 10A is completely interrupted in 0.04 s Calculate the induced emf in the coil.

$N = 300$

$l = 25 = 25\times10^{-2}\ m$

$A = 3\ cm^2 = 3\times10^{-4}\ m$

$L = ?$

$I = 10A$ $\qquad L = \frac{N^2}{S} = \frac{N^2}{\frac{l}{\mu_0 \mu_r A}} = \frac{N^2 \times \mu_0 \mu_r A}{l}$

$= 300^2 \times \dfrac{4\pi \times 10^{-7} \times 1 \times 3 \times 10^{-4}}{25 \times 10^{-2}}$

$= 1.35 \times 10^{-4}$ H

$e = L\dfrac{dI}{dt} V = 1.35 \times 10^{-4} \times \dfrac{10}{0.04} = 0.03375$ or 0.034 V

? An air core toroid coil has 450 turns and a mean diameter of 30 cm and a cross sectional area $3 cm^2$. Calculate the inductance of the coil and the average emf induced if a current of 10 A is reversed in 0.04 s.

$N = 450$

$d = 30 = 30 \times 10^{-2}$ m $dI = 2-(-2)$

$l = \pi d = \pi \times 30 \times 10^{-2}$ m

$A = 3 \times 10^{-4} m^2$

$L = \dfrac{N^2}{S} = N^2 \dfrac{\mu_0 \mu_r A}{l} = \dfrac{450^2 \times 4\pi \times 10^{-7} \times 1 \times 3 \times 10^{-4}}{\pi \times \cancel{30} \times 10^{-2}}$ 10

$= \cancel{8.1 \times 10^{-5}} H$ $\cancel{1.35 \times 10^{-4} H} = 8.1 \times 10^{-5}$ H

~~$e = L\dfrac{dI}{dt} = \dfrac{8.1 \times 10^{-5} \times 10}{0.04} = 0.0337$~~

$e = L\dfrac{dI}{dt} = 8.1 \times 10^{-5} \dfrac{4}{0.04} = 8.1 \times 10^{-3}$ volt

? Two coils having 150 and 200 turns respectively are wound side by side on a closed magnetic circuit of cross section $1.5 \times 10^{-2} m^2$ and a mean length of 3 m. The relative permeability of the magnetic circuit is

2000 (i) Calculate the mutual inductance b/w the coils.
(ii) Voltage induced in the 2nd coil if the current changes from 0 to 10A in the first coil in 20 ms?

Ans: $N_1 = 150$

$N_2 = 200$

$A = 1.5 \times 10^{-2} m^2$

$l = 3 m$

$\mu_r = 2000$

(i) $M = \frac{N_1 N_2 \mu_0 \mu_r A}{l} = \frac{150 \times 200 \times 4\pi \times 10^{-7} \times 2000 \times 1.5 \times 10^{-2}}{3}$

$= \underline{\underline{0.3768 \text{ H}}}$

(ii) $e = M \times \frac{di_1}{dt}$

$M = 0.3768$ H

$\frac{di_1}{dt} = \frac{10-0}{20 \times 10^{-3}} = \underline{\underline{500}}$

$e = 0.3768 \times 500 = \underline{\underline{188.4 \text{ V}}}$

7 Two identical coils A and B of 800 turns each are magnetically coupled so that 90% of flux produced by one coil links with the other. If 2 A current flowing in the first coil produces 1.2 mWb in it. Find the mutual inductance b/w the coils.

Ans: $N = 800$

~~ϕ 90%~~ $\phi_1 = 1.2$ mWb

$I = 2A$

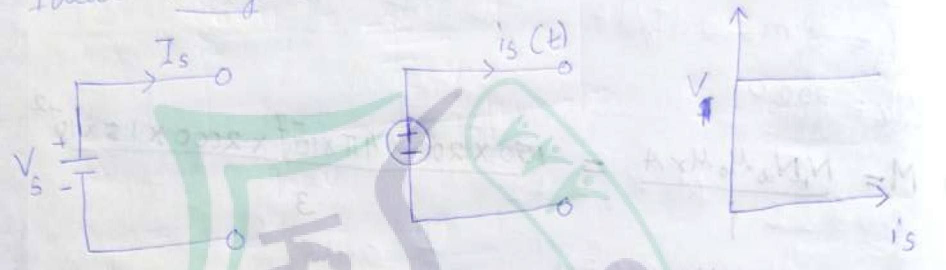
$\phi_2 = 1.2 \times 10^{-3} \times \frac{90}{100} = 1.08 \times 10^{-3}$

$M_1 = \cancel{\frac{N_1 \Phi_1}{I_2} = 800\times}$

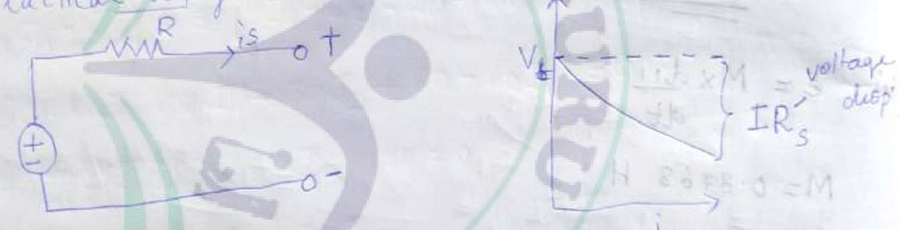
$M_2 = \frac{N_2 \Phi_2}{I_1} = \frac{800 \times 1.08 \times 10^{-3}}{2} = \underline{0.432\ H}$

~~Ideal~~ Energy sources

Ideal voltage source

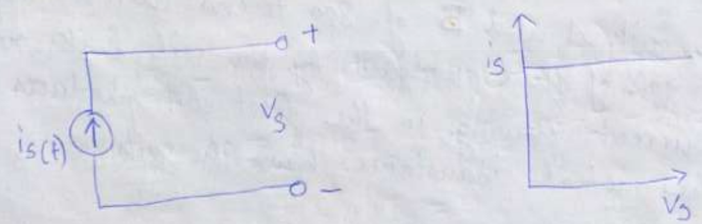


Practical voltage source

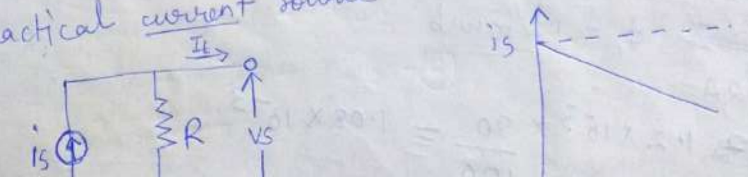


Current source

Ideal current source



Practical current source



Comparison b/w Electrical and Magnetic Circuit

Magnetic Circuit	Electric Circuit
1) Magnetic flux $= \frac{MMF}{Reluctance}$	1) Electric current $= \frac{EMF}{Resistance}$
2) Reluctance, $S = \frac{l}{\mu A}$	2) Resistance, $R = \rho l/A$
3) Permeance, $\Lambda = \frac{1}{Reluctance}$	3) Conductance $= \frac{1}{Resistance}$

5) $N = 900$

$r = 25\,cm = 25\times10^{-2}\,m$

Diameter of turn $= 4\,cm = 4\times10^{-2}\,m$

$I = 9\,A$

• mmf, $F = NI = 900\times9 = 8100\,A$

$A = \pi r^2 = \pi\left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4} = \frac{\pi\times(4\times10^{-2})^2}{4} = 1.256\times10^{-3}\,m^2$

~~$l = 2\pi r = 2\times3.14\times25\times10^{-2}$~~

~~$S = \frac{l}{\mu_0 \mu_r A}$~~

$l = 2\pi r = 2\times3.14\times25\times10^{-2} = 1.57\,m$

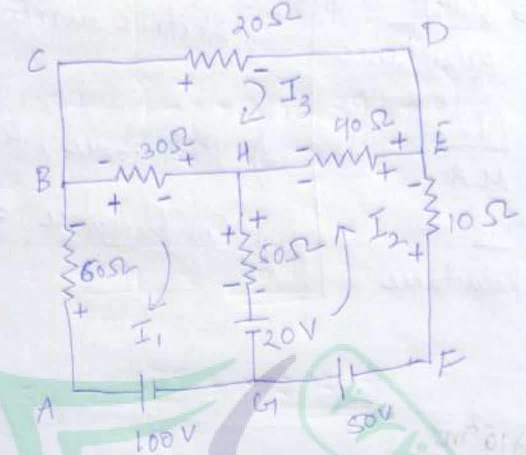
• $S = \frac{l}{\mu_0\mu_r A} = \frac{1.57}{4\pi\times10^{-7}\times1\times1.256\times10^{-3}} = 9.95\times10^{8}\,A/wb$

$S = F/\phi \therefore \phi S = F$

• $\phi = F/S = \frac{8100}{9.95\times10^{8}} = 8.14\times10^{-6}\,wb$

• $B = \phi/A = \frac{8.14\times10^{-6}}{1.256\times10^{-3}} = 6.48\times10^{-3}\,wb/m^2$

1) Calculate the current in each branch of the following circuit using mesh Analysis.



-30-50-60

Loop-1

$-30(I_1 - I_3) - 50(I_1 + I_2) - 20 + 100 - 60 I_1 = 0$

$-30I_1 + 30I_3 - 50I_1 - 50I_2 + 80 - 60I_1 = 0$

$-140I_1 - 50I_2 + 30I_3 + 80 = 0$ -10-40-50

$80 = 140I_1 + 50I_2 - 30I_3$

$8 = 14I_1 + 5I_2 - 3I_3$ — ①

Loop-2

$-50 - 10I_2 - 40(I_2 + I_3) - 50(I_2 + I_1) - 20 = 0$

$-50 - 10I_2 - 40I_2 - 40I_3 - 50I_2 - 50I_1 - 20 = 0$

$-70 - 100I_2 - 50I_1 - 40I_3 = 0$

$-70 = 50I_1 + 100I_2 + 40I_3$

$-7 = 5I_1 + 10I_2 + 4I_3$ — ②

Loop - 3

$-20-40-30$

$-20I_3 - 40(I_3 + I_2) - 30(I_3 - I_1) = 0$

$-20I_3 - 40I_3 - 40I_2 - 30I_3 + 30I_1 = 0$

$-90I_3 - 40I_2 + 30I_1 = 0$

$0 = -30I_1 + 40I_2 + 90I_3$

$0 = -3I_1 + 4I_2 + 9I_3 \quad (3)$

$$\begin{bmatrix} 8 \\ -7 \\ 0 \end{bmatrix} = \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} \begin{bmatrix} 14 & 5 & -3 \\ 5 & 10 & 4 \\ -3 & 4 & 9 \end{bmatrix}$$

$$\Delta = \begin{bmatrix} 14 & 5 & -3 \\ 5 & 10 & 4 \\ -3 & 4 & 9 \end{bmatrix} = \begin{array}{ccccc} 14 & 5 & -3 & 14 & 5 \\ 5 & 10 & 4 & 5 & 10 \\ -3 & 4 & 9 & -3 & 4 \end{array}$$

$= (1260 - 60 - 60) - (90 + 224 + 225)$

$= 601$

$$\Delta_1 = \begin{bmatrix} 8 & 5 & -3 \\ -7 & 10 & 4 \\ 0 & 4 & 9 \end{bmatrix} = \begin{array}{ccccc} 8 & 5 & -3 & 8 & 5 \\ -7 & 10 & 4 & -7 & 10 \\ 0 & 4 & 9 & 0 & 4 \end{array}$$

$= (720 + 0 + 84) - (0 + 128 - 315)$

$= 991$

$$\Delta_2 = \begin{bmatrix} 14 & 8 & -3 \\ 5 & -7 & 4 \\ -3 & 0 & 9 \end{bmatrix} = \begin{array}{ccccc} 14 & 8 & -3 & 14 & 8 \\ 5 & -7 & 4 & 5 & -7 \\ -3 & 0 & 9 & -3 & 0 \end{array}$$

$= (-882 - 96 + 0) - (-63 + 0 + 360)$

$= -1275$

$$\Delta_3 = \begin{bmatrix} 14 & 5 & 8 \\ 5 & 10 & -7 \\ -3 & 4 & 0 \end{bmatrix} = \begin{matrix} 14 & 5 & 8 & 14 & 5 \\ 5 & 10 & -7 & 5 & 10 \\ -3 & 4 & 0 & -3 & 4 \end{matrix}$$

$$= (0 + 105 + 160) - (-240 - 392 + 0)$$

$$= 897$$

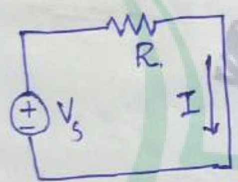
$$I_1 = \frac{\Delta_1}{\Delta} = \frac{991}{601} = 1.64 \text{ A}$$

$$I_2 = \frac{\Delta_2}{\Delta} = \frac{-1275}{601} = -2.12 \text{ A}$$

$$I_3 = \frac{\Delta_3}{\Delta} = \frac{897}{601} = 1.49 \text{ A}$$

* Similarity

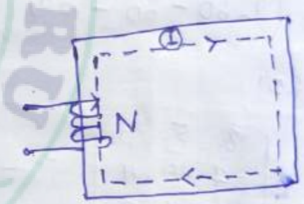
ELECTRIC CIRCUIT



- In electric circuit current wave flows through a closed path
- EmF is the driving force for the flow of current in the electric circuit. It's unit volt (V).
- Current, $I = \frac{\text{em.f}}{\text{Resistance}}$

  Its unit is ampere (A)

MAGNETIC CURRENT



- In magnetic circuit, magnetic flux will be established in a closed path.
- MMF is the driving force that will establish magnetic flux in the magnetic circuit. Its unit is A or AT.
- Magnetic flux, $\phi = \frac{\text{MMF}}{\text{Reluctance}}$

~~ELECTRI~~	
• The flow of no. of electrons decides the magnitude of current in conductor.	• The no. of magnetic lines of force decides the magnitude of flux.
• Resistance opposes the flow of current $R = \rho l/A$ Unit = ohm (Ω)	• Reluctance opposition faced by the magnetic flux in the magnetic circuit. $S = F/\phi$ $S = \frac{NI}{1/\mu_0 \mu_r A}$
• KVL and KCL is applicable to electric circuit.	• K. MMF law and flux law is applicable to magnetic circuit.

DISSIMILARITIES

ELECTRIC CIRCUIT	MAGNETIC CIRCUIT
• The current will flow in electric circuit due to the movement of electron	• In magnetic circuit magnetic flux will be established but nothing is flowing inside the magnetic field.
• There are many materials which can be used as good insulators.	• There is no magnetic insulator as flux can pass through all the materials even through the air as well.
• Energy must be supplied to the electric circuit to ~~the~~ maintain the flow of current	• Energy is required to create the flux but it is not required to maintain it.
• The resistance and conductance are independent of current density under constant temp,	• The reluctance, permeance and permeability depends on the flux density.

but may change due to the temp.

* Electric lines of flux are not closed, they start from +ve charge and end on -ve charge.

- The magnetic lines of flux are closed line, they flow from north pole to south pole externally, south pole to north pole internally.