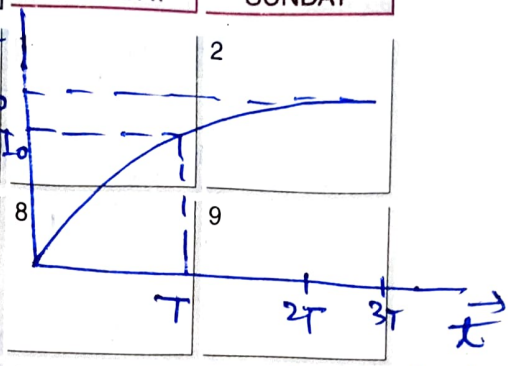
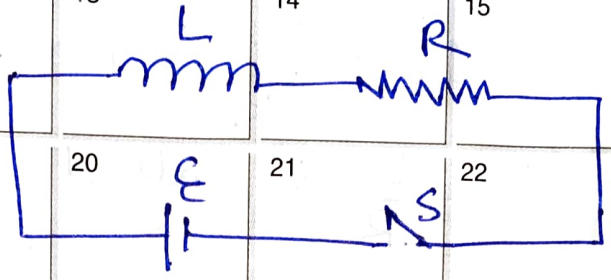
GROWTH & DECAY OF CURRENTS IN L-R CIRCUITS

May-2004

L = Inductance.
R = Resistance.



GROWTH OF CURRENT



L = Inductance
R = Resistance
ε = e.m.f
S = switch

The current at any instant is given by.

$$I = I_0\left(1 - e^{-\frac{R}{L}t}\right)$$

Where,

I = Instaneous current.

I_0 = maximum current $\left(\frac{E}{R}\right)$ or steady current.

R = Resistance. L Inductance and $\frac{L}{R}$ = time Constant.

If $t = \frac{L}{R}$, then $\frac{R}{L} = \frac{1}{t}$

$$\therefore I = I_0\left(1 - e^{-1}\right) = I_0\left(1 - \frac{1}{2.718}\right)$$

$$= 0.632\ I_0$$

Therefore, time Constant $\left(\frac{L}{R}\right)$ of a circuit may be defined as the time taken by the current to grow from zero to 0.632 times the maximum value of the final steady value.

02 May
Sunday
18 WEEK
123-243

DECAY OF CURRENT

The current at any instant the decay is given by,

$$I = I_0 e^{-\frac{R}{L}t}$$

Here, $I_0 = \frac{E}{R}$ = max. current and $\frac{L}{R}$ is called time constant

Evening

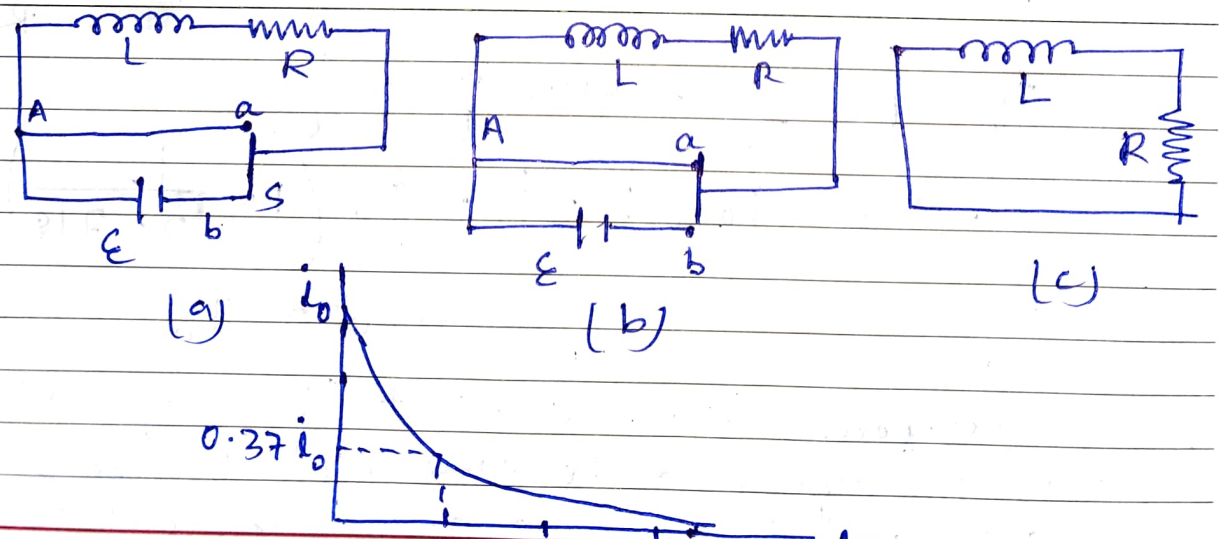
If $t = \frac{L}{R}$

03 May
Monday
19 WEEK
124-242

then, $I = I_0 e^{-1} = \frac{I_0}{e}$

$= 0.368\ I_0$

therefore, time constant may also be defined as the time taken by the current to decrease from maximum value of 0.368 times of its maximum value.



Evening