

GROWTH & DECAY OF CURRENTS

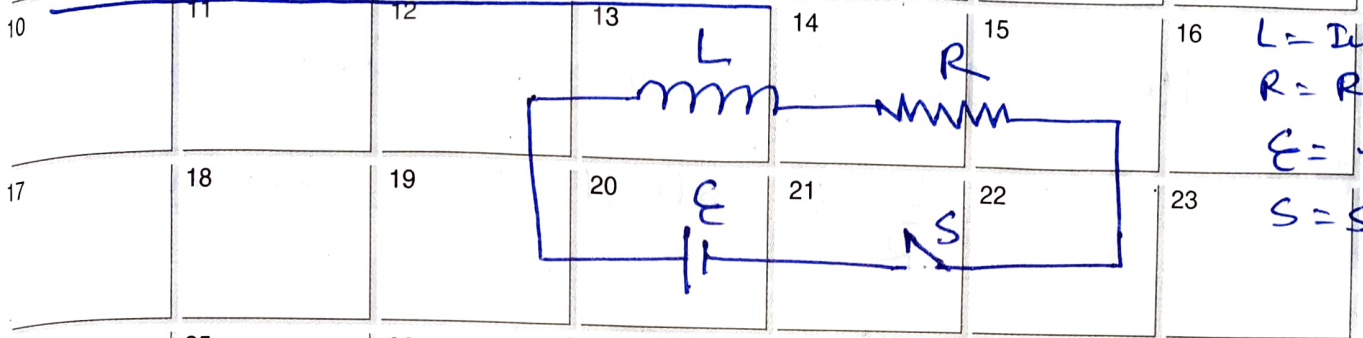
May-2004

IN L-R CIRCUITS

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MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
		$L =$ Inductance $R =$ Resistance				
3	4	5	6	7	8	9

GROWTH OF CURRENT



$L =$ Inductance
 $R =$ Resistance
 $E =$ e.m.f.
 $S =$ Switch

The current at any instant is given by

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

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Where,

- $I =$ instantaneous current,
- $I_0 =$ maximum current $\left(\frac{E}{R} \right)$ or steady current.
- $R =$ Resistance, L inductance as $\frac{L}{R} =$ time constant

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

$$\begin{aligned}
 \therefore I &= I_0 (1 - e^{-1}) = I_0 \left(1 - \frac{1}{2.718} \right) \\
 &= 0.632 I_0
 \end{aligned}$$

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.

June	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
04		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30											



DECAY OF CURRENT

The current at any instant the decay is given by,

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

Here, $I_0 = \frac{E}{R} = \text{max. current and}$

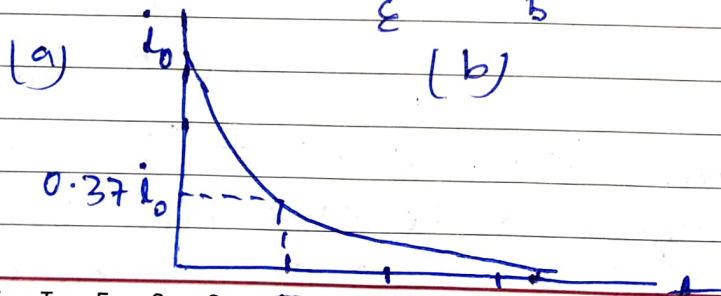
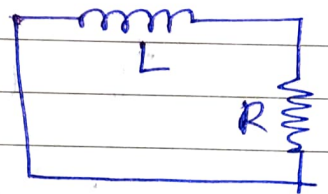
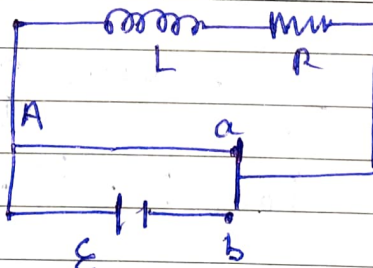
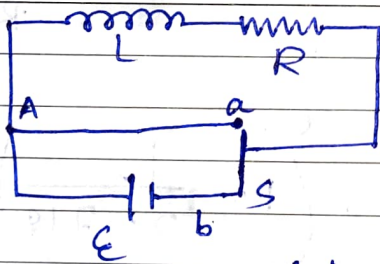
$\frac{L}{R}$ is called time constant

Evening

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

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

may	M	T	W	T	F	S	S	T	T	2T	T	3T	S	S	M	T	W	T	F	S	S	
04	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31							16