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① what is De and Ac current.

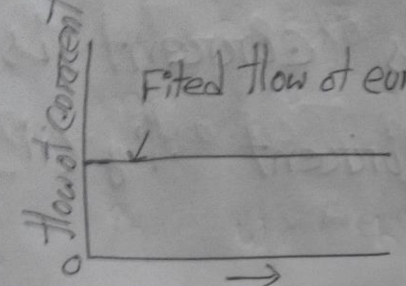


Fig: ① De current

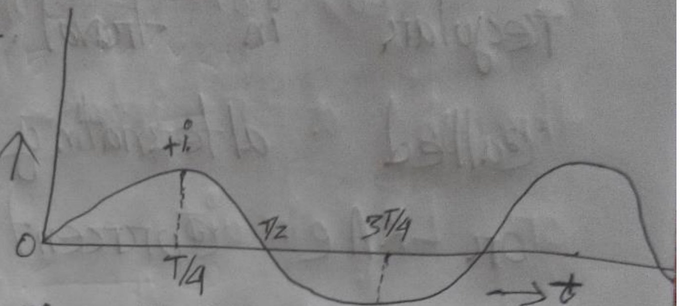


Fig: (ii) Ac Current.

we know that the direction of current which is obtained from an eletrie will or a battery is always in one direction. In order to charge the direction of current in the circuit a commutator is used this flow of current is called direct current or De current. It's value of magnitode may not remain fixed but direction neverchange But there is a source of current from which the flow of corrent in the circuit.

changes direction sponteneoosly at a regular in traval. This current is called alternating current fig (ii) or Ac current.

Reactance : It may be defined as the effective opposition offere by the inductor or capacitor to flow of a.c current for a pure capacitance c the reactance is given by,

$$X_c = \frac{1}{2\pi f c}$$

where f is the frequency of a.c current.

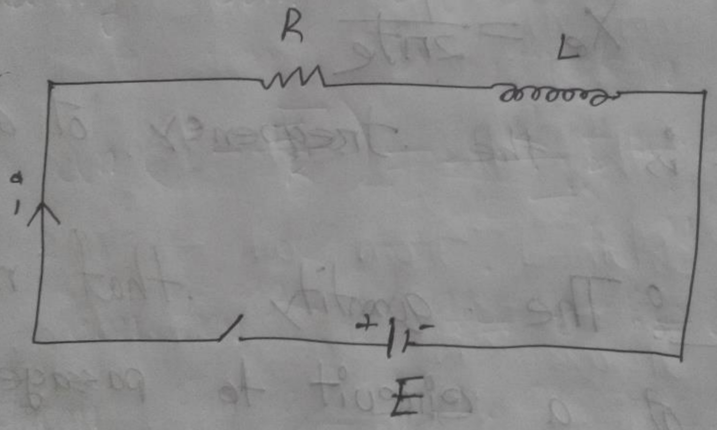
Impedence : The quantity that measure the opposition of a circuit to passage of a current and therefor determines the amlitude of the current in a dc circuit this is the resistance (R) alone. In an ac circuit. It is denoted by Z.

$$Z^2 = R^2 + X_L^2$$

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

For LR circuit.

4. Find the expression for the growth and decay of charge of a Inductor through a resistance with constant emf or LR circuit —



Growth of current in LR circuit :

let us consider a circuit containing an inductance L in series with a resistance. R which is connected with a source of constant emf E which can be suddenly induced or removed by the switch. At the time of closing the switch induced emf across the L is

$$E = L\frac{di}{dt} \quad \text{——— (1)}$$

From kirshoff's voltage low we get,

$$E = iR + L\frac{di}{dt}$$

$$\text{or } E - iR = L\frac{di}{dt}$$

$$\text{or } \frac{di}{E - iR} = \frac{dt}{L}$$

$$\text{or } \frac{di}{-R(i - E/R)} = \frac{1}{L} dt$$

$$\therefore \frac{di}{i - E/R} = -\frac{R}{L} dt$$

Integrating both sides we get,

$$\ln\left(i - \frac{E}{R}\right) = -\frac{R}{L} t + \text{constant} \quad \text{--- (11)}$$

Boundary conditions at $t = 0, i = 0$
then from (11) we get,

$$\ln\left(-\frac{E}{R}\right) = \text{constant}.$$

Dotting this in equation (11) we get

$$\ln(i - E/R) = -R/L\,t + \ln(-E/R)$$

$$\ln\left(i - E/R\right) - \ln\left(-E/R\right) = -R/L\, t$$

$$\text{or } \frac{i - E/R}{-E/R} = e^{-R/L\, t}$$

$$\text{or } i - E/R = -E/R\, e^{-R/L\, t}$$

$$\text{or } i = E/R - E/R\, e^{-R/L\, t}$$

$$\text{or } i = E/R\left(1 - e^{-R/L\, t}\right)$$

$$\text{or, } i = i_0\left(1 - e^{-R/L\, t}\right)$$

This is the equation for growth of current, Instant time constant,

$$T_L = L/R$$

$$i = i_0\left(1 - e^{-t/T_L}\right)$$

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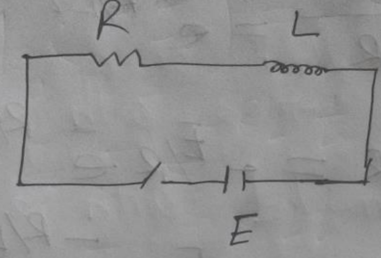
Decay of current in LR circuit :



When the emf is broken an induced emf is equal to $-L\frac{di}{dt}$ is again produced is the inductane L and it shown down the rate of decay of current we know the circuit equation.

$$E = L\frac{di}{dt} + RI \text{ ——— (1)}$$

when the current in the circuit decay from maximum value I_0 to Zero. In this case $I = 0$, $E = 0$

So we equation ①

$$0 = L\frac{dI}{dt} + RI$$

or, $L\frac{dI}{dt} = -RI$

or $\frac{dI}{dt} = -\frac{R}{L} I$

or $\frac{dI}{I} = -\frac{R}{L} dt$

integating this equation

$$\int \frac{dI}{I} = -R/L \, dt$$

$$\log E = -R/L \, t + e \quad \text{———} ①$$

When $t = 0$ and $I = I_0$ then $e = \log I_0$

Substituting the value of e in eq^n (11)

$$\log I = -R/L \, t + \log eI_0$$

or $\log I - \log I_0 = -R/L\, t$

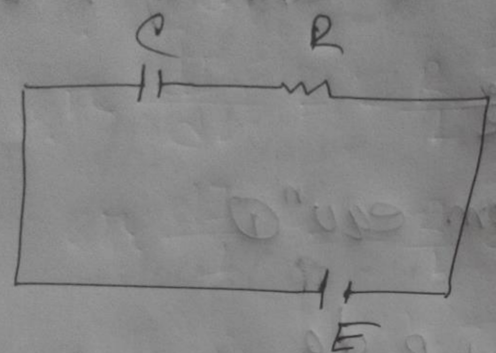
or $\log_e (I/I_0) = -R/L\, t$

or $I/I_0 = e^{-R/L\, t}$

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

This is the equation for decay of current is LR circuit.

Find an expression for the growth and decay of change of a capacitor through a resistor with constant emf.



Charging or groth of capacitor through a resistance: let us consider a circuit consisting a capacitor of capacitance C and a resistance R conneeted with a cell groth emf E.

The emf of this circuit,

$$E = q/C + RI$$

$$\therefore E = q/C + R \cdot \frac{dq}{dt} \text{ ——— } (1)$$

If $Q = Q_0$ maximum charge at that instant $I = \frac{dQ}{dt} = 0$. The potential difference across the capacitor P is

$$E = \frac{Q_0}{C}$$

so we get from equ^n (1)

$$\frac{Q_0}{C} = \frac{Q}{C} + R\frac{dQ}{dt}$$

$$\text{or } \frac{Q_0}{C} - \frac{Q}{C} = R\frac{dQ}{dt}$$

$$\text{or } \frac{Q_0 - Q}{C} = R\frac{dQ}{dt}$$

$$\text{or } Q_0 - Q = RC\frac{dQ}{dt}$$

$$\text{or } \frac{1}{RC}dt = \frac{dQ}{Q_0 - Q}$$

Integrating this equation we get

$$\int \frac{dQ}{Q_0 - Q} = \frac{1}{RC}\int dt$$

$$-\log(Q_0 - Q) = \frac{1}{Rc} t + c \quad \text{--- (ii)}$$

when $t = 0$, $Q = 0$ then

$$-\log Q_0 = c$$

Putting this value in eqn (ii)

$$-\log_e(Q_0 - Q) = \frac{t}{Rc} - \log Q_0$$

or, $\log(Q_0 - Q) - \log Q_0 = -\frac{t}{Rc}$

or $\log \frac{Q_0 - Q}{Q} = -t/Rc$

or $1 - Q/Q_0 = e^{-t/Rc}$

$$\therefore Q = Q\left(1 - e^{-t/Rc}\right) \quad \text{--- (iii)}$$