CHARGING & DISCHARGING CONDENSER IN C-R CIRCUIT

CHARGING :

A Capacitor C may be charged or discharged through a resistor R.

charging is done by connecting a battery of emf $\mathcal{E}_0$, capacitor C and a resistor R in series.

If i is the instantaneous value of current at an instant t through R, the potential difference across the capacitor will be $\mathcal{E}_0 - Ri$.

If q is the instantaneous charge on the capacitor at this instant t, then we have

$$\mathcal{E}_0 - Ri = q/c$$

or $$\mathcal{E} - q/c = Ri$$

Since $i = \frac{dq}{dt}$, hence

$$\mathcal{E} - \frac{q}{c} = R\frac{dq}{dt}$$

or, $$\frac{dq}{\mathcal{E} - q/c} = \frac{dt}{R}$$

On integrating, assuming $\mathcal{E}$ and C as constants, we get

$$-C \log_e (\mathcal{E} - q/c) = t/R + \text{const.}$$