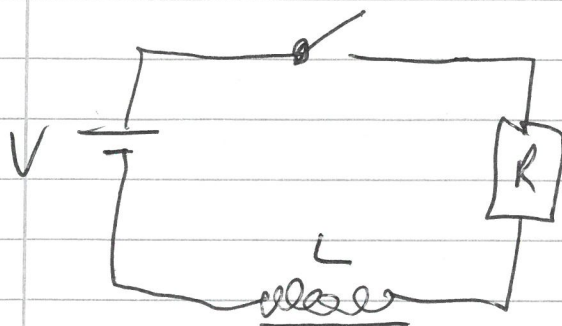$$\boxed{EM - \text{lecture } 18}$$

$$IR + L\frac{dI}{dt} = V$$

$$L\frac{dI}{dt} = -(IR - V)$$

$$\frac{dI}{dt} = -\frac{R}{L}\left(I - V/R\right)$$

$$\int \frac{dI}{(I - V/R)} = -\frac{R}{L}\int dt$$

$$\ln\left(I - V/R\right) + \ln C = -\frac{R}{L}t$$
$$\underset{\text{constant}}{\uparrow}$$

$$\Rightarrow \quad C\left(I - V/R\right) = e^{-\frac{R}{L}t}$$

$$I = \frac{V}{R} + \frac{1}{C}e^{-\frac{R}{L}t}$$

$$t = 0, \quad I = 0, \quad e^{-\frac{R}{L}t} = 1$$

$$\Rightarrow \frac{1}{C} = -\frac{V}{R}$$

①

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

$$\frac{V}{R} = I_o \quad \text{steady state current}$$

$$\text{call} \quad \frac{L}{R} = \tau$$

$$\text{ie} \quad I(t) = I_o\left(1 - e^{-t/\tau}\right)$$