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2110326 2 Date
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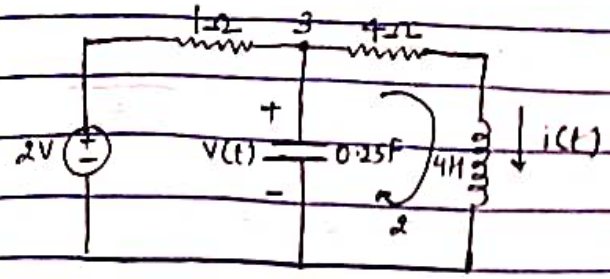
ES-II (Assignment-1)

Q.1.




Apply KVL in loop ②

$$V(t) - 4i(t) - 4\frac{di(t)}{dt} = 0$$

$$V(t) = 4i(t) + 4\frac{di(t)}{dt} \quad \text{— ①}$$

Apply KCL at ③

$$\frac{V(t) - 2}{1} + i(t) + 0.25\frac{dV(t)}{dt} = 0 \quad \text{— ②}$$

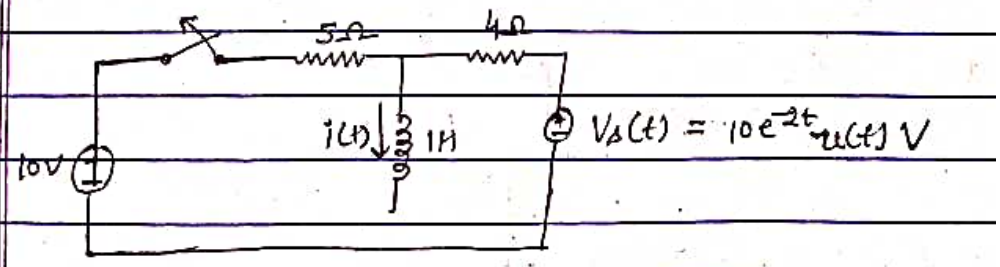
from ① & ② we get :-

$$4i(t) + 4\frac{di(t)}{dt} - 2 + i(t) + 0.25\frac{d}{dt}\left(4i(t) + 4\frac{di(t)}{dt}\right) = 0$$

$$5i(t) - 2 + 5\frac{di(t)}{dt} + \frac{d^2i(t)}{dt^2} = 0$$

$$\frac{d^2i(t)}{dt^2} + 5\frac{di(t)}{dt} + 5i(t) - 2 = 0$$

Q.2.




$$V_s(t) = 4i(t) + \frac{di}{dt}$$

$$\frac{di}{dt} + 4i(t) = 10e^{-2t} \quad \text{— ①}$$

forced response : $i_f = Be^{-2t}$

$$-2Be^{-2t} + 4Be^{-2t} = 10e^{-2t}$$

$$2B = 10 \rightarrow \boxed{B = 5}$$

Natural response : $i_n(t) = Ae^{-t/\tau}$

$$\tau = \frac{1}{4}$$

$$i_n(t) = Ae^{-4t}$$

$$i(0^-) = 2A$$

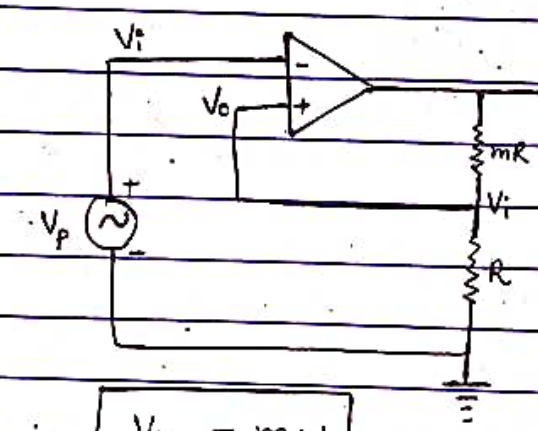
$$A + 5 = 2$$

$$A = -3$$

$$i_n(t) = -3e^{-4t}$$

Total Response : $i(t) = -3e^{-4t} + 5e^{-2t}$ A

Q.3.



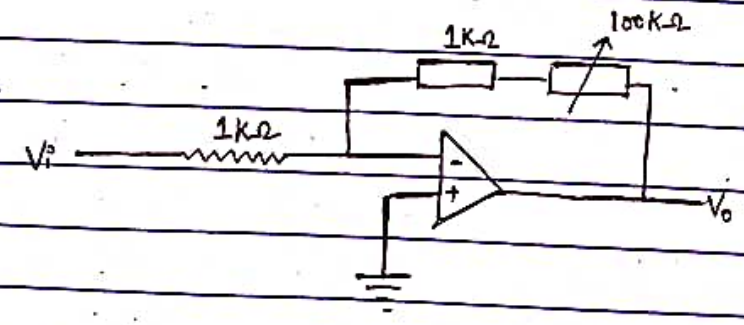

$$\frac{V_o - V_i}{mR} = \frac{V_i - 0}{R}$$

$$\frac{V_o - V_i}{V_i} = m$$

$$\frac{V_o}{V_i} - 1 = m$$

$$\boxed{\frac{V_o}{V_i} = m + 1}$$

Q.4.




maximum closed loop gain : $\frac{V_o}{V_i} = -\frac{R_f}{R_i}$

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$$= -\left(\frac{100\times10^3}{10^3}+1\right) = \boxed{-101}$$ ✓

minimum closed loop gain : $\frac{V_o}{V_i} = \frac{-R_f}{R_i} = \frac{-10^3}{10^3}$

$$\boxed{\frac{V_o}{V_i} = -1}$$ ✓