ID:	Name:

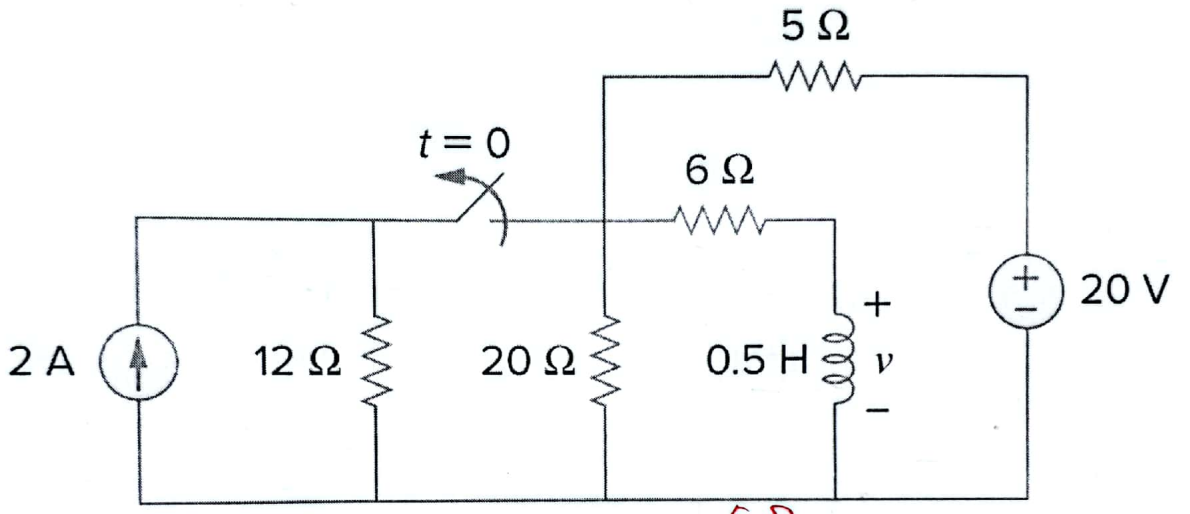
Brac University
Semester: Summer 2023
Course Code: CSE250
Circuits And Electronics
Section: 23
Faculty: PRM

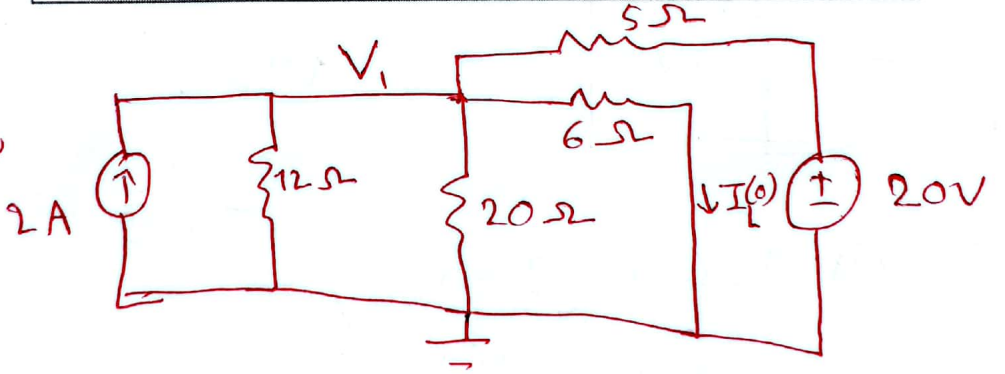
Assessment: *Assignment-4*

- ✓ Submit softcopy online by deadline
- ✓ Submit hardcopy in class by deadline

■ Question 1 of 3 *[CO1] [10 marks]*

Determine v(t) and $i_L(t)$ for t<0 and t>0.





for t<0,

$$-2 + \frac{V_1}{12} + \frac{V_1}{20} + \frac{V_1}{6} + \frac{V_1 - 20}{5} = 0$$

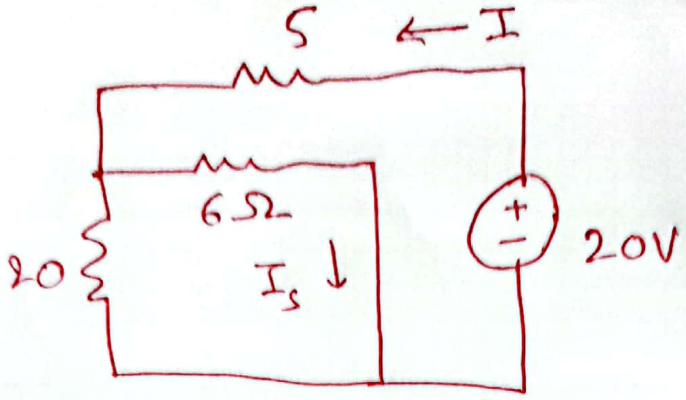
or, $V_1 = 12\,V$

$\therefore I_L(0) = i_L(0) = \frac{V_1}{6} = 2A$

$v(0) = 0V$

~~for t>0,~~

For $t>0$,

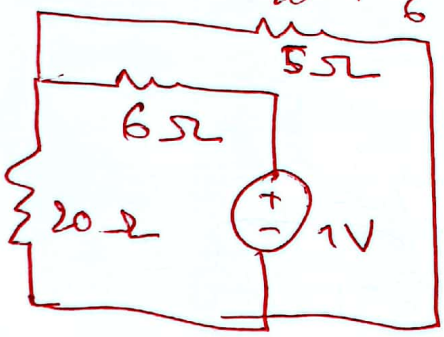


$$R_{eq} = 5 + \left(\frac{1}{20} + \frac{1}{6}\right)^{-1} = 9.62\,\Omega$$

$$I = \frac{20}{R_{eq}} = 2.08\,A$$

$$I_s = i_L(\infty) = \frac{\frac{1}{6}}{\frac{1}{20}+\frac{1}{6}} \times 2.08 = 1.6\,A$$

$R \Rightarrow$



$$R = 6 + \left(\frac{1}{20} + \frac{1}{5}\right)^{-1}$$

$$= 10\,\Omega$$

$$\therefore i_L(t) = 1.6 + (2-1.6)e^{-\frac{10t}{0.5}}$$

$$= 1.6 + 0.4e^{-20t}$$

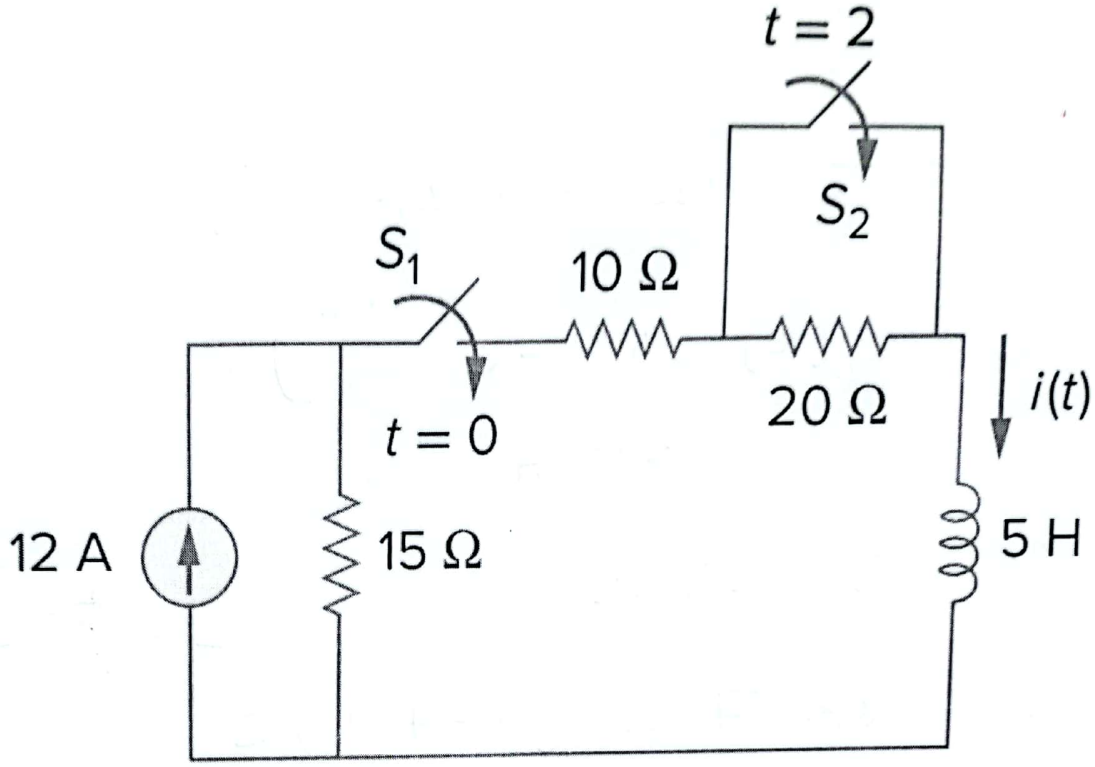
$$v(t) = L\frac{di_L(t)}{dt} = -4e^{-20t}$$

$$\therefore i_L(t) = \begin{cases} 2, & t \le 0 \\ 1.6 + 0.4e^{-20t}, & t > 0 \end{cases}$$

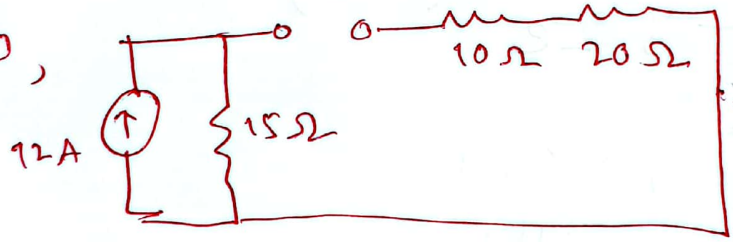
$$v(t) = \begin{cases} 0, & t \le 0 \\ -4e^{-20t}, & t > 0 \end{cases}$$

Question 2 of 3 *[CO1] [10 marks]*

Determine i(t) for t<0, t>0 and t>2.

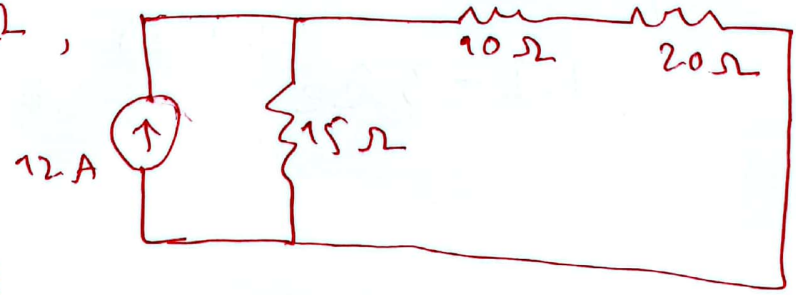


For $t < 0$,



$\therefore i_L(0) = 0\ A$

For $0 < t < 2$,

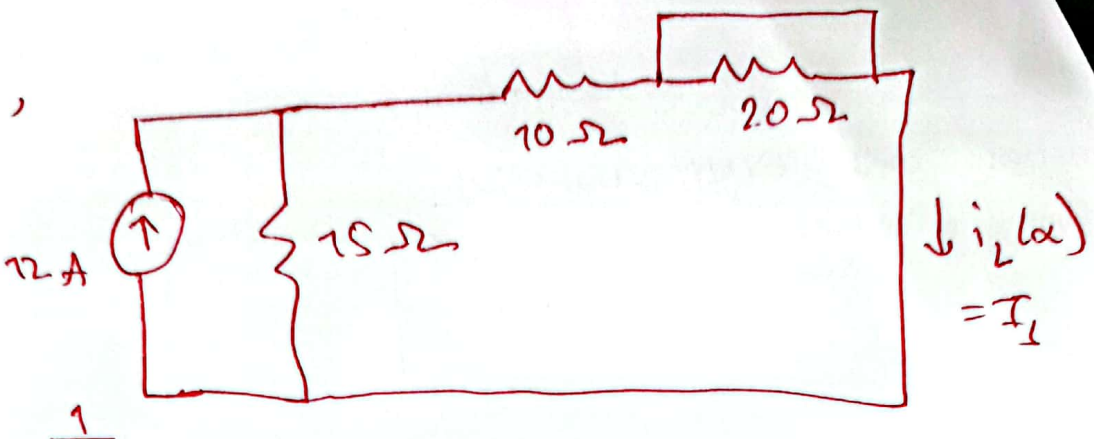


$$I_s = \frac{\frac{1}{30}}{\frac{1}{15}+\frac{1}{30}} \times 12 = 4\ A$$

$$R = 10 + 20 + 15 = 45\ \Omega$$

$$\therefore i_L(t) = 4 - 4e^{-\frac{45t}{5}} = 4\left(1 - e^{-9t}\right)\ A$$

For $t > 2$,



$$i_L(\infty) = \frac{\frac{1}{10}}{\frac{1}{15}+\frac{1}{10}} \times 12 = 7.2A = I_s$$

Here, $I_0 = i_L(2) = 4(1-e^{-9\times 2})$

$\approx 4A$

$R = 10 + 15 = 25\Omega$ $\quad -\frac{25(t-2)}{5}$

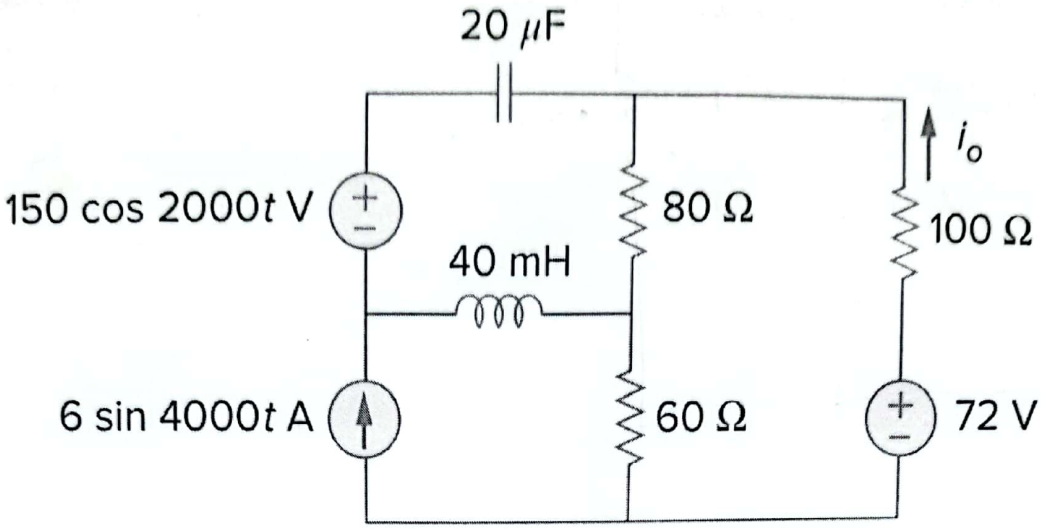
$\therefore i_L(t) = 7.2 + (4-7.2)e^{-5(t-2)}$

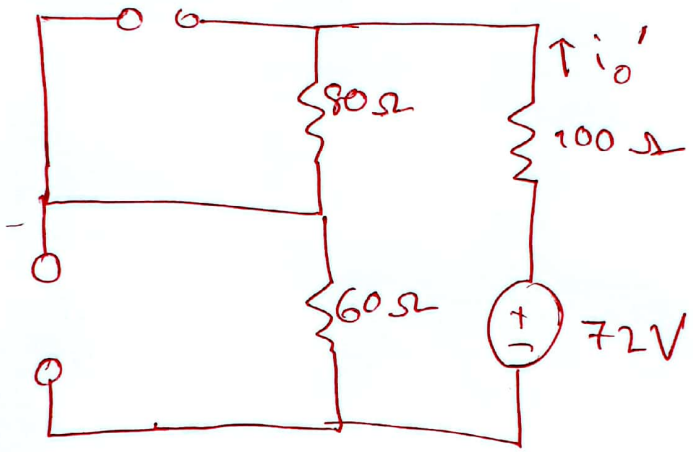
$= 7.2 - 3.2e^{-5(t-2)}$

$$\therefore i_L(t) = \begin{cases} 0, & t \le 0 \\ 4(1-e^{-9t}), & 0 \le t \le 2 \\ 7.2 - 3.2e^{-5(t-2)}, & t > 2 \end{cases}$$

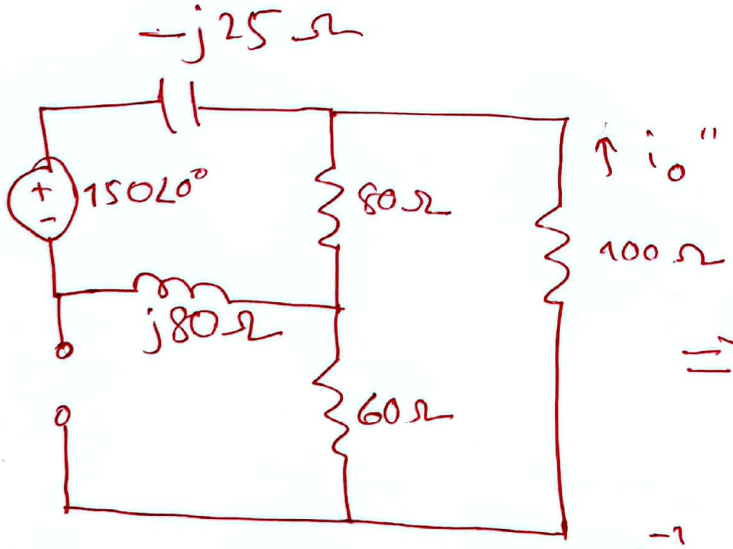
uestion 3 of 3 *[CO1] [10 marks]*

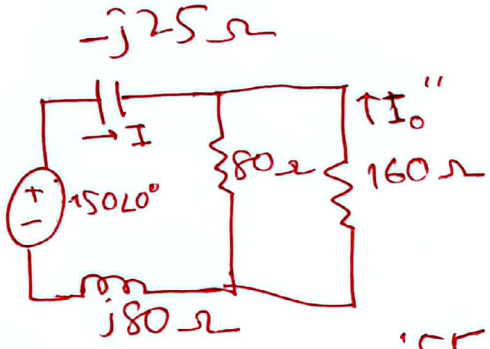
Determine $i_o(t)$.





$$i_o' = \frac{72}{100+80+60} = 0.3\,A$$





$$Z_{eq} = -j25 + \left(\frac{1}{80}+\frac{1}{160}\right)^{-1} + j80 = 53.33 + j55$$

$$I = \frac{150\angle 0^\circ}{Z_{eq}} = 1.96\angle -45.88^\circ\ A$$

$$I_o'' = -\frac{80}{80+160} I = 0.65\angle 134.12^\circ\ A$$