

LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

EE 240 Circuits I
Quiz 9

Solution Manual.

Name: _____

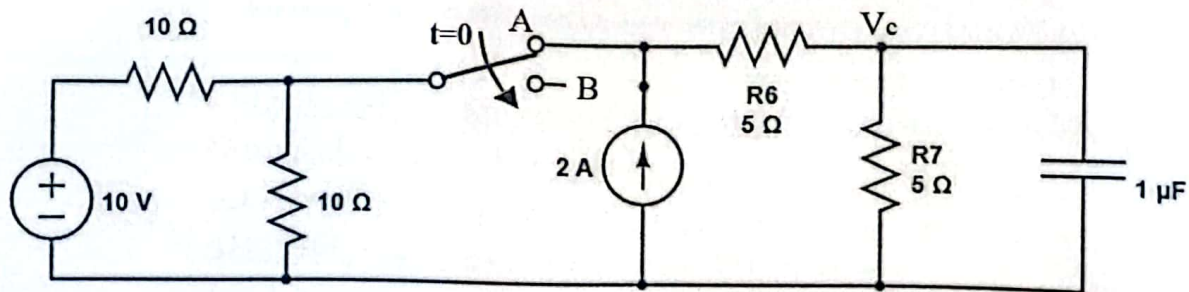
Campus ID: _____

Total Marks: 10

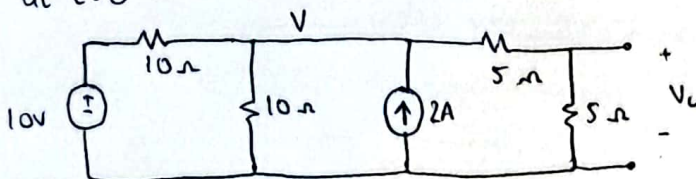
Time Duration: 15 minutes

Question 1 (5 marks)

In the circuit shown, the switch has been in position A for a long time. At $t = 0$ the switch is moved to position B. Determine $\frac{dv}{dt}(0^+)$.



at $t = 0^-$



Nodal equation at node V

$$\frac{V-10}{10} + \frac{V}{10} + \frac{V}{10} = 2$$

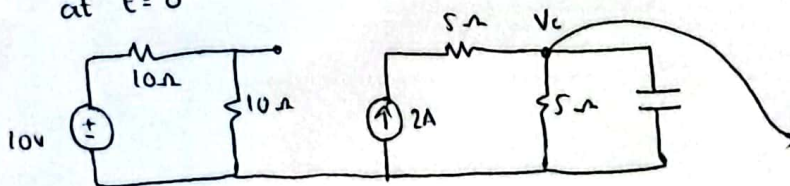
$$3V - 10 = 20$$

$$3V = 30$$

$$V = 10V$$

$$V_c = \frac{5}{10} \times 10 = 5V$$

at $t = 0^+$



Nodal equation

$$2 = \frac{V_c}{5} + C \frac{dV_c}{dt}$$

evaluation this equation at $t = 0^+$

$$2 = \frac{V_c(t=0^+)}{5} + C \frac{dV_c(t=0^+)}{dt}$$

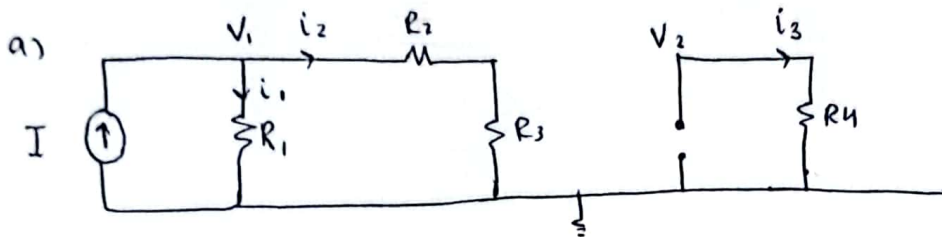
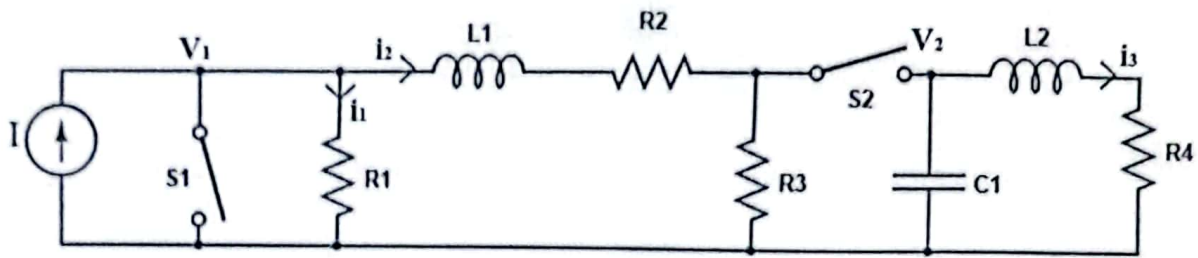
$$\frac{C dV_c(t=0^+)}{dt} + 2 - \frac{5}{5} = 1$$

$$\frac{dV_c(t=0^+)}{dt} = \frac{1}{C} = \frac{1}{1 \times 10^{-6}} = 10^6 \text{ V/s}$$

Question 2 (5 marks)

(a) Draw the circuit at $t = 0^-$. Find $i_1(0^-)$, $i_2(0^-)$, $i_3(0^-)$, $V_1(0^-)$, and $V_2(0^-)$.

(b) Draw the circuit at $t = 0^+$. Find $i_1(0^+)$, $i_2(0^+)$, $i_3(0^+)$, $V_1(0^+)$, and $V_2(0^+)$.



This was at $t = 0^-$

$$i_3 = 0 \text{ A}$$

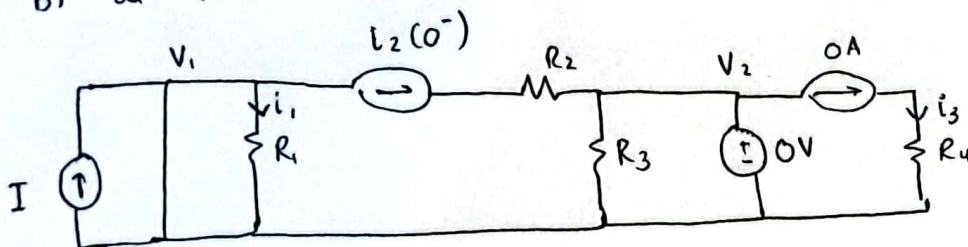
$$V_2 = 0 \text{ V}$$

$$i_1 = \frac{R_2 + R_3}{R_1 + R_2 + R_3} I$$

$$i_2 = \frac{R_1}{R_1 + R_2 + R_3} I$$

$$V_1 = \frac{R_2 + R_3}{R_1 + R_2 + R_3} I R_1 = i_1 R_1$$

b) at $t = 0^+$



$$i_3 = 0 \text{ A}$$

$$V_2 = 0 \text{ V}$$

$$i_1 = 0 \text{ A}$$

$$V_1 = 0 \text{ V}$$

$$i_2 = i_2(0^-)$$

$i_1(0^+) = 0 \text{ A}$ because there's a short wire next to resistor R_1 , current will take path of least resistance

0 A $\rightarrow$ this acts like an open circuit

0 V $\rightarrow$ this acts like a short circuit