

LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
 Department of Electrical Engineering

EE240 Circuits I
Quiz 05 Solutions

Name: _____

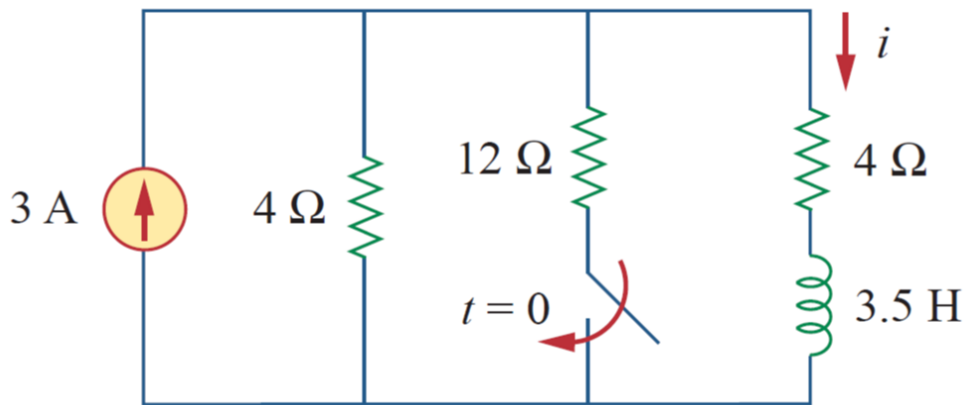
Campus ID: _____

Total Marks: 10

Time Duration: 20 minutes

Question 1 (10 marks)

In a first-order circuit given below, the switch that has been opened for a long time is closed at $t = 0$.



- (a) [2 marks] Determine the current $i(t)$ at $t = 0^-$ and $t = 0^+$.

Solution:

$$i(0^-) = i(0^+) = 1.5 \text{ A}$$

- (b) [2 marks] Write down the differential equation, in terms of $i(t)$, describing the circuit after the switch is operated, that is, for $t \geq 0$.

Solution:

$$\frac{1}{3} \left(4i + 3.5 \frac{di}{dt} \right) + i = 3$$

$$3.5 \frac{di}{dt} + 2i = \frac{9}{3.5}$$

- (c) [2 marks] Determine $i(t)$ at $t = \infty$.

Solution:

$$i(\infty) = \frac{9}{7} \text{ A}$$

- (d) [4 marks] Determine $i(t)$ for all values of t and plot (and label) it.

Solution: For $t \geq 0$:

$$\tau = (3.5)/R_{eq} = 3.5/7 = 0.5$$

$$i(t) = K_1 + K_2 e^{-2t}$$

$$i(t) = \frac{9}{7} + \frac{3}{14} e^{-2t} \text{ A}$$