LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

EE240 Circuits I
Quiz 01 Solutions

Name: _____

Campus ID: _____

Total Marks: 10
Time Duration: 15 minutes

Question 1 (4 marks)

The charge on the capacitor of capacitance $0.5F$ is plotted against time in Figure 1 below.

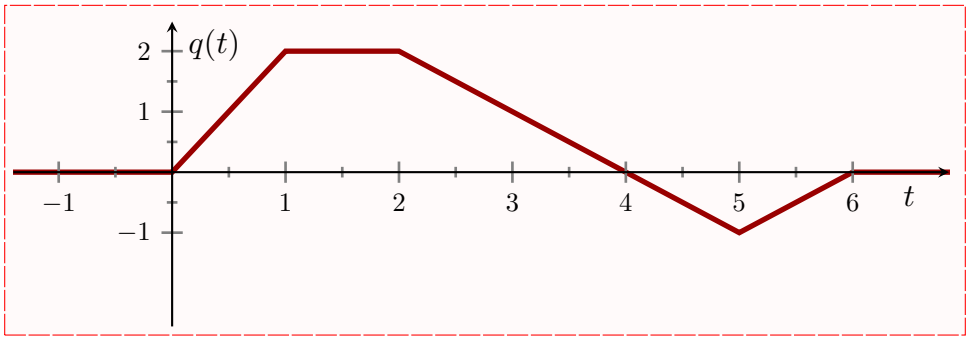


Figure 1: Charge on the Capacitor.

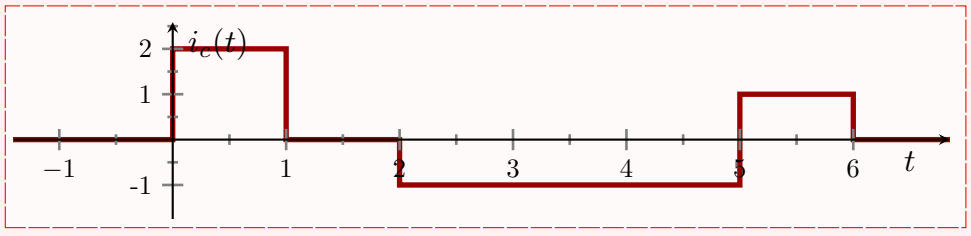
(a) [3 marks] Determine (or plot) the current $i_c(t)$ through the capacitor.

Solution: The current through the capacitor is given by

$$i_c(t) = \frac{dq(t)}{dt}$$

$$i_c(t) = \begin{cases} 0 & t \leq 0 \\ 2 & 0 < t \leq 1 \\ 0 & 1 < t \leq 2 \\ -1 & 2 < t \leq 5 \\ 1 & 5 < t \leq 6 \\ 0 & 6 < t \end{cases}$$

The plot is given below:



(b) [1 mark] Determine the energy stored in the capacitor at $t = 1.5s$.

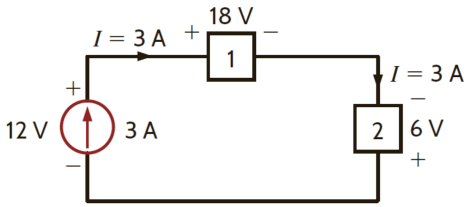
Solution: Energy in the capacitor is given by $w = \frac{1}{2}CV^2 = \frac{q^2}{2C}$. Since $q(1.5) = 2\,\text{Coulombs}$, $w = 4\,J$.

Question 2 (2 marks)

The current source is connected to elements 1 and 2 in series in the circuit given below. Determine

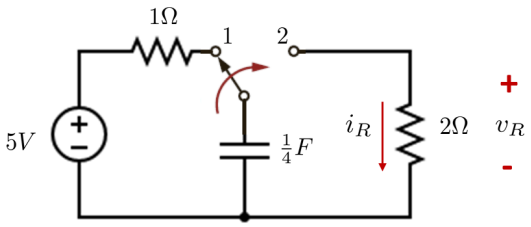
the power being *supplied* by the current source and the power being *absorbed or dissipated* by the elements.

Solution: Current source supplies 36 W. Element 1 absorbs 54 W and element 2 absorbs -18 W (using passive sign convention).



Question 3 (4 marks)

Consider the circuit given below. Assume that the switch is at position 1 for very long time and the capacitor is fully charged. The switch is moved from position 1 to position 2 at $t = 0$. Plot $v_R(t)$ and $i_R(t)$ for all times.



Solution: Capacitor is fully charged means that the voltage across capacitor is $5V$. $v_R(t)$ is zero for $t \leq 0$. As soon the switch is operated $v_R(t) = 5V$ which decays exponentially to zero with time. Mathematically, $v_R(t) = 5e^{-2t}u(t)\,V$ and $i_R = 2.5e^{-2t}u(t)\,A$.