LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

EE240 Circuits I
Quiz 01 - Section 1 - Solutions

Name: _____

Campus ID: _____

Total Marks: 10
Time Duration: 15 minutes

Question 1 (10 marks)

(a) [8 marks] The current $i_c(t)$ through the capacitor of capacitance $\frac{1}{2}F$ is shown in Figure 1 below. Determine the voltage across the capacitor. Also plot the voltage for $-2 \leq t \leq 5$.

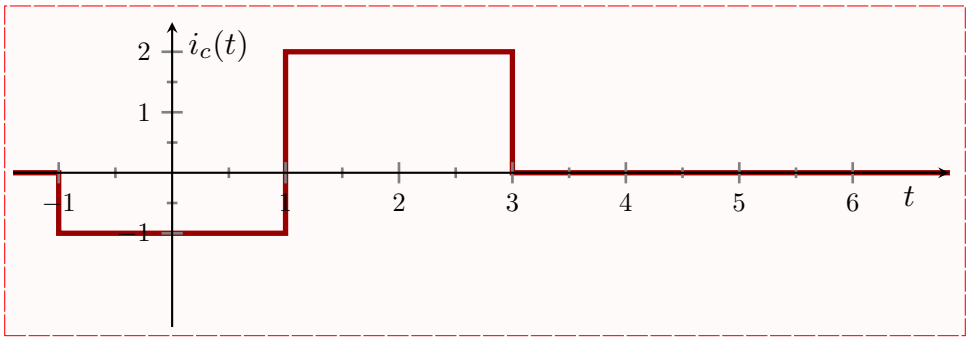

Figure 1: Current through the Capacitor.

Solution: Voltage across capacitor is given by

$$v_c = \frac{1}{C}\int_{-\infty}^{t} i_c(t)dt = 2\int_{-\infty}^{t} i_c(t)dt$$

$$v_c = \begin{cases} 0 & t \leq -1 \\ 2\int_{-1}^{t}(-1)dt = -2(t+1) = -2t-2 & -1 < t \leq 1 \\ 2\int_{-1}^{1}(-1)dt + 2\int_{1}^{t}(2)dt = 4t-8 & 1 < t \leq 3 \\ 2\int_{-1}^{1}(-1)dt + 2\int_{1}^{3}(2)dt = 4 & 3 < t \end{cases}$$

The plot is given below:

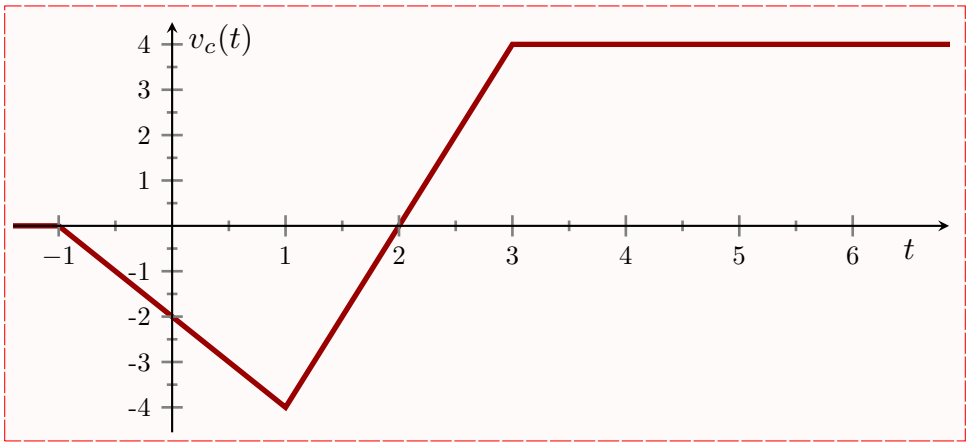

Figure 2: Voltage across the Capacitor.

(b) [1 mark] Draw the $i - v$ characteristics of an ideal DC voltage source.

Solution: Line parallel to the current (i) axis on the $i - v$ plot.

(c) [1 mark] Write an expression to relate the voltage and current for the capacitor.

Solution:

$$i_c(t) = C\,\frac{d\,v_c(t)}{dt}, \quad \text{or} \quad v_c = \frac{1}{C}\int_{-\infty}^{t} i_c(t)dt$$