EE240 Circuits I
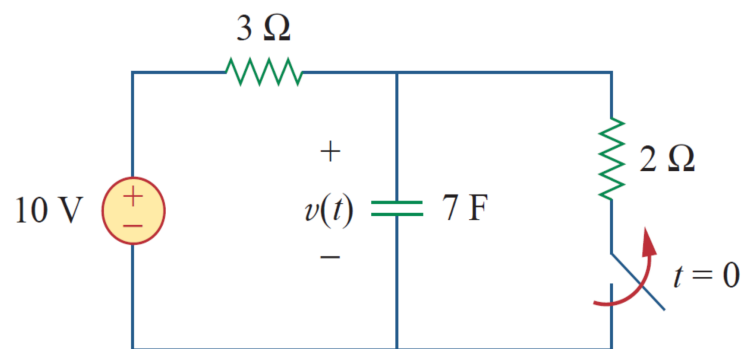**Quiz 06 Solutions**

Name: _____

Campus ID: _____

Total Marks: 10
Time Duration: 20 minutes
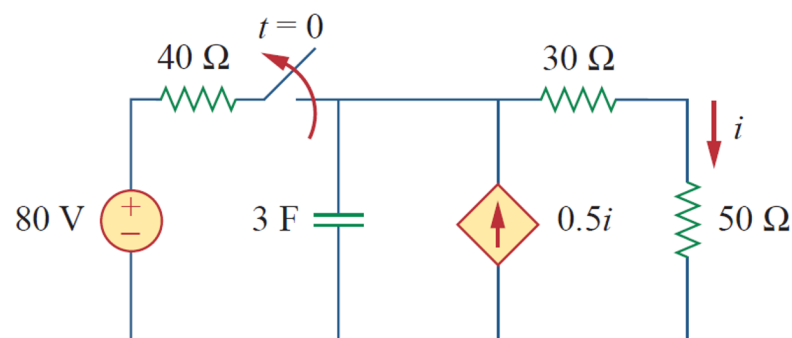
Question 1 (2 marks)

In the circuit given below, the switch is opened at $t = 0$. Find $v(t)$ at $t = 0^+$.

Solution: $v(0^+) = \frac{2}{5} \times 104\,V$.

Question 2 (8 marks)

In the circuit given below, the switch is opened at $t = 0$.

(a) [2 marks] Determine the voltage across capacitor at $t = 0^-$. (Hint: Use Nodal Analysis)

Solution: Analysing the circuit at $t = 0^-$ and applying nodal analysis yields in terms of v (voltage across capacitor)

$$\frac{v - 80}{40} + \frac{v}{80} = 0.5i$$

i is related to v as $i = \frac{v}{80}$ or $v = 80i$. Substituting this in the above equation gives $v = 64V$, which is the voltage across capacitor at both $t = 0^-$ and $t = 0^+$.

(b) [2 marks] Determine $i(t)$ at $t = 0^+$ and $i(t)$ at $t = \infty$.

Solution: $i(0^+) = v(0^+)/80 = 0.8\,A$, $i(0^+) = 0\,A$

(c) [4 marks] Determine and plot (with labels) $i(t)$ for all times.

Solution: We have
$$i(t) = K_1 + K_2 e^{-t/\tau},$$
where $K_1 = 0$ and $K_2 = 0.8$. To find τ, we use Thevenin's theorem to find $R_{eq} = 160\,\Omega$ across capacitor and therefore $\tau = 160 \times 3 = 480\,s$.