Use engineering paper. Work only on one side of the paper. Use this sheet as your cover sheet, placed on top of your work and stapled in the top left-hand corner. Number the problems at the top of the page, in the center of the sheet. **Do neat work. Underline your answers. Show how you got your equations. Be sure to show how you got your answers.** Each problem counts 10 points.

7.41 \( v(t) = 10(1 - e^{-0.2t}) u(t) \) V

7.44 \( i(t) = -3e^{0.25t} u(t) \) A

7.52 \( i(t) = 2 u(t) \) A

7.63 \( i(t) = 2e^{-8t} u(t) \) A

\( v(t) = -8e^{-8t} u(t) \) A

7.66 \( v(t) = 2.5(e^{-40t} - 1) u(t) \) V
Find $V(t)$ for $t > 0$

![Circuit Diagram](image)

$V(t) = V(\infty) + (V(0) - V(\infty)) e^{-\frac{t}{R C}}$

- $V(\infty) = \frac{12 \times 30}{36} = 10 V$
- $V(0) - V(\infty)$

$T = R C$; $R C = 30 \times 6 = \frac{30 \times 6}{36} = 5 \text{ sec}$

$T = 5 \times 1 = 5 \text{ sec}$

$V(t) = 10 + (0 - 10) e^{-0.2t}$

$V(t) = \left[10 - 10 e^{-0.2t}\right] u(t) \text{ V}$

![Graph](image)
7.44 Switch has been closed for a long time. At \( t=0 \) it is moved from position a to position b. Find \( i(t) \) for \( t>0 \).

\[
\begin{align*}
V_{0} &= 30V \\
V_1 &= 12V \\
C &= 2F
\end{align*}
\]

Find the values for the form:

\[
V(t) = V(\infty) + [V(0) - V(\infty)]e^{-\frac{t}{\tau}}
\]

\[
V(0^-) = \frac{30 \times 3}{9} = 10V = V(0^+)
\]

\[
V(\infty) = \frac{12 \times 3}{3 + 6} = 4V
\]

\[
\tau_1 = \frac{6 \times 3}{6 + 3} = 2.5 \quad \tau = 2 \times 2 \tau_1
\]

\[
V(t) = 4 + [10 - 4]e^{-\frac{t}{4}}
\]

\[
\begin{align*}
V(t) &= \left(4 + 6e^{-0.25t}\right) V \\
j &= C \frac{dV}{dt} = 2 \times 6 \times (-0.25) e^{-0.25t} \\
j(t) &= -3e^{-0.25t} A
\end{align*}
\]
\textbf{7.52} \quad \text{Find } i(t) \text{ for } t \geq 0.

\begin{align*}
\text{For } t < 0 \\
\frac{i(t)}{10} &= \frac{i(t^+)}{10} = \frac{20}{10} = 2 \text{ A} \\
i(\infty) &= 2 \text{ A} \\
\gamma &= \frac{L}{5L} = \frac{5}{8} \\
i(t) &= i(\infty) + \left[i(0) - i(\infty)\right]e^{-\frac{8t}{5}u(t)} \text{ A}
\end{align*}

\text{At } t = 0, \quad i(t) = -2 \text{ A}
\[7.63\]

\[\text{Find } V(t) \text{ and } i(t)\]

\[5\Omega\]

\[10 \text{u}(t)\]

\[20 \text{H}\]

\[\text{HN}\]

\[V_H\]

\[i(t)\]

\[\text{HN}\]

\[0.5 \text{H}\]

\[t < 0, \]

\[i(0^-) = i'(0^+) = \frac{10}{5} = 2 \text{A}\]

\[V(0^-) = 0\]

\[t > 0\]

\[\lambda(\infty) = 0\]

\[R_{eq} = 5 \Omega \times 20 = 100 \Omega\]

\[M = \frac{L}{R_{eq}} = \frac{0.5 \times 10^{-3}}{4} = \frac{1}{8}\]

\[\lambda'(0) = 0\]

\[\lambda(t) = \lambda(\infty) + [\lambda(0) - \lambda(\infty)]e^{-\frac{t}{\tau}}\]

\[\lambda(t) = 2e^{-0.5t}\]

\[V(t) = -\frac{\partial i(t)}{\partial t} = 0.5 \times 2 (-8)e^{-8t}\]

\[V(t) = -8e^{-8t}\]
\[
\frac{(D - 1)}{70K} + \frac{(D - V_0)}{50K} - 0.5 \times 10^{-6} \frac{\partial V_0}{\partial t} = 0
\]

\[
0.5 \times 10^{-6} \frac{\partial V_0}{\partial t} + \frac{V_0}{50 \times 10^3} = \frac{-1}{20 \times 10^3}
\]

\[
\frac{\partial V_0}{\partial t} + 2 \times 10^4 \frac{V_0}{50 \times 10^3} = -\frac{2 \times 10^4}{20 \times 10^3}
\]

\[
\frac{1}{40} = \tau \Leftrightarrow C
\]

\[
V_0 = V_{0t} + V_{0ss}
\]

\[
V_{0t} = Ke^{-40t} \quad V_{0ss} = \frac{100}{40} = -2.5
\]

\[
V_0 = Ke^{-40t} = -2.5
\]

\[
V_0(10) = (V_0(0)) = 0 \quad \therefore K = 2.5
\]

\[
V_0(\tau) = 2.5 (e^{-40t} - 1) + 1 V
\]