Solution of ECE 300 Test 7 F11

1.   Fill in the blanks with numbers.

$v_1(0^-) =$ _____ V $v_2(0^-) =$ _____ V $v_L(0^-) =$ _____ V

$v_1(0^+) =$ _____ V $v_2(0^+) =$ _____ V $v_L(0^+) =$ _____ V

$i_1(0^-) =$ _____ A $i_L(0^-) =$ _____ A

$i_1(0^+) =$ _____ A $i_L(0^+) =$ _____ A

$\tau =$ _____ ms

$V_s = 14\text{V}$, $R_1 = 9\Omega$, $R_2 = 20\Omega$, $L = 150$ mH
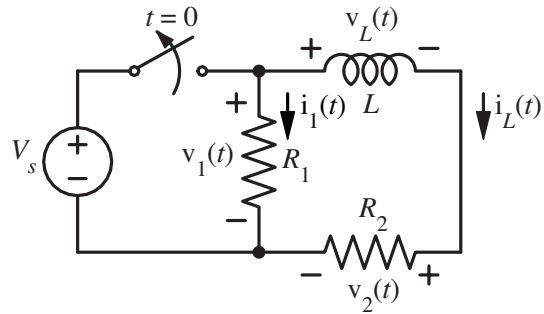
$v_1(0^-) = V_s = 14\text{V}$ $v_2(0^-) = V_s = 14\text{V}$ $v_L(0^-) = 0\text{V}$

$v_1(0^+) = i_1(0^+) \times R_1 = -6.3\text{V}$ $v_2(0^+) = i_L(0^+) \times R_2 = 14\text{V}$ $v_L(0^+) = v_1(0^+) - v_2(0^+) = -20.3\text{V}$

$i_1(0^-) = V_s / R_1 = 14 / 9 = 1.556$ A $i_L(0^-) = V_s / R_2 = 14 / 20 = 0.7$ A

$i_1(0^+) = -i_L(0^+) = -0.7$ A $i_L(0^+) = i_L(0^-) = 0.7$ A

$\tau = L / R_{eq} = 0.15 / 29 = 5.17$ ms

2.   Fill in the blanks with numbers.

$i_1(0^-) = $ _____ A $i_2(0^-) = $ _____ A $i_3(0^-) = $ _____ A $i_C(0^-) = $ _____ A

$i_1(0^+) = $ _____ A $i_2(0^+) = $ _____ A $i_3(0^+) = $ _____ A $i_C(0^+) = $ _____ A

$i_1(\infty) = $ _____ A $i_2(\infty) = $ _____ A $i_3(\infty) = $ _____ A $i_C(\infty) = $ _____ A

$v_1(0^-) = $ _____ V $v_2(0^-) = $ _____ V $v_C(0^-) = $ _____ V $v_i(0^-) = $ _____ V

$v_1(0^+) = $ _____ V $v_2(0^+) = $ _____ V $v_C(0^+) = $ _____ V $v_i(0^+) = $ _____ V

$v_1(\infty) = $ _____ V $v_2(\infty) = $ _____ V $v_C(\infty) = $ _____ V $v_i(\infty) = $ _____ V

$\tau = $ _____ μs

$$v_s(t) = 40 + 20\,u(t)\ ,\ i_s(t) = 2u(-t)\ ,\ R_1 = 4\Omega$$
$$R_2 = 11\Omega\ ,\ R_3 = 9\Omega\ ,\ C = 10\mu F$$
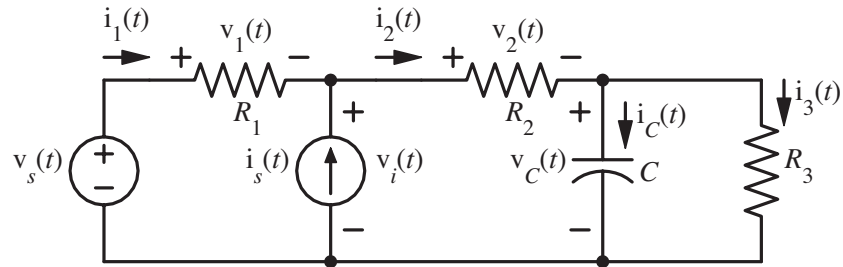
$$i_1(0^-) = \frac{v_s(0^-)}{R_1 + R_2 + R_3} - i_s(0^-)\frac{R_2 + R_3}{R_1 + R_2 + R_3} = \frac{40}{24} - 2\frac{20}{24} = 0$$
$$v_1(0^-) = i_1(0^-)R_1 = 0V$$

$$i_2(0^-) = \frac{v_s(0^-)}{R_1 + R_2 + R_3} + i_s(0^-)\frac{R_1}{R_1 + R_2 + R_3} = \frac{40}{24} + 2\frac{4}{24} = 2A$$
$$v_2(0^-) = i_2(0^-)R_2 = 22V$$

$i_1(0^-) = 0A$ $\quad i_2(0^-) = 2A$ $\quad i_3(0^-) = i_2(0^-) = 2A$ $\quad i_C(0^-) = 0A$

$i_1(0^+) = \dfrac{v_s(0^+) - v_C(0^+)}{R_1 + R_2} = 42/15 = 2.8A$ $\quad i_2(0^+) = i_1(0^+) = 2.8A$ $\quad i_3(0^+) = v_C(0^+)/R_3 = 2A$ $\quad i_C(0^+) = i_2(0^+) - i_3(0^+) = 0.8A$

$i_1(\infty) = \dfrac{v_s(\infty)}{R_1 + R_2 + R_3} = \dfrac{60}{24} = 2.5A$ $\quad i_2(\infty) = i_1(\infty) = 2.5A$ $\quad i_3(\infty) = i_1(\infty) = 2.5A$ $\quad i_C(\infty) = 0A$

$v_1(0^-) = 0V$ $\quad v_2(0^-) = 22V$ $\quad v_C(0^-) = i_3(0^-)R_3 = 18V$ $\quad v_i(0^-) = v_C(0^-) + v_2(0^-) = 40V$

$v_1(0^+) = i_1(0^+)R_1 = 11.2V$ $\quad v_2(0^+) = i_2(0^+)R_2 = 30.8V$ $\quad v_C(0^+) = v_C(0^-) = 18V$ $\quad v_i(0^+) = v_C(0^+) + v_2(0^+) = 48.8V$

$v_1(\infty) = i_1(\infty)R_1 = 10V$ $\quad v_2(\infty) = i_2(\infty)R_2 = 27.5V$ $\quad v_C(\infty) = i_3(\infty)R_3 = 22.5V$ $\quad v_i(\infty) = v_C(\infty) + v_2(\infty) = 50V$

$$\tau = R_{eq}C = R_3 \,\|\, (R_1 + R_2)C = 56.25\ \mu s$$

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1.   Fill in the blanks with numbers.

$v_1(0^-) =$ _____ V $v_2(0^-) =$ _____ V $v_L(0^-) =$ _____ V

$v_1(0^+) =$ _____ V $v_2(0^+) =$ _____ V $v_L(0^+) =$ _____ V

$i_1(0^-) =$ _____ A $i_L(0^-) =$ _____ A

$i_1(0^+) =$ _____ A $i_L(0^+) =$ _____ A

$\tau =$ _____ ms

$V_s = 21\text{V}$, $R_1 = 9\Omega$, $R_2 = 20\Omega$, $L = 150 \text{ mH}$

$v_1(0^-) = V_s = 21\text{V}$ $v_2(0^-) = V_s = 21\text{V}$ $v_L(0^-) = 0\text{V}$

$v_1(0^+) = i_1(0^+) \times R_1 = -9.45\text{V}$ $v_2(0^+) = i_L(0^+) \times R_2 = 21\text{V}$ $v_L(0^+) = v_1(0^+) - v_2(0^+) = -30.45\text{V}$

$i_1(0^-) = V_s / R_1 = 21/9 = 2.333 \text{ A}$ $i_L(0^-) = V_s / R_2 = 21/20 = 1.05 \text{ A}$

$i_1(0^+) = -i_L(0^+) = -1.05 \text{ A}$ $i_L(0^+) = i_L(0^-) = 1.05 \text{ A}$

$\tau = L / R_{eq} = 0.15 / 29 = 5.17 \text{ ms}$
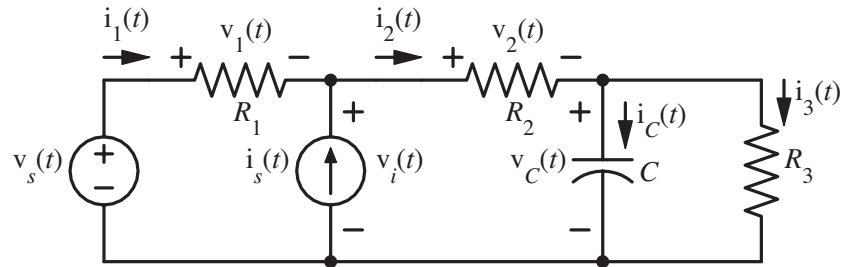
2. Fill in the blanks with numbers.

$i_1(0^-) =$ _____ A $\quad i_2(0^-) =$ _____ A $\quad i_3(0^-) =$ _____ A $\quad i_c(0^-) =$ _____ A

$i_1(0^+) =$ _____ A $\quad i_2(0^+) =$ _____ A $\quad i_3(0^+) =$ _____ A $\quad i_c(0^+) =$ _____ A

$i_1(\infty) =$ _____ A $\quad i_2(\infty) =$ _____ A $\quad i_3(\infty) =$ _____ A $\quad i_c(\infty) =$ _____ A

$v_1(0^-) =$ _____ V $\quad v_2(0^-) =$ _____ V $\quad v_C(0^-) =$ _____ V $\quad v_i(0^-) =$ _____ V

$v_1(0^+) =$ _____ V $\quad v_2(0^+) =$ _____ V $\quad v_C(0^+) =$ _____ V $\quad v_i(0^+) =$ _____ V

$v_1(\infty) =$ _____ V $\quad v_2(\infty) =$ _____ V $\quad v_C(\infty) =$ _____ V $\quad v_i(\infty) =$ _____ V

$\tau =$ _____ μs

$v_s(t) = 20 + 10\,u(t)$, $i_s(t) = u(-t)$, $R_1 = 4\Omega$
$R_2 = 11\Omega$, $R_3 = 9\Omega$, $C = 10\mu F$

$$i_1(0^-) = \frac{v_s(0^-)}{R_1 + R_2 + R_3} - i_s(0^-)\frac{R_2 + R_3}{R_1 + R_2 + R_3} = \frac{20}{24} - \frac{20}{24} = 0$$

$$v_1(0^-) = i_1(0^-)R_1 = 0V$$

$$i_2(0^-) = \frac{v_s(0^-)}{R_1 + R_2 + R_3} + i_s(0^-)\frac{R_1}{R_1 + R_2 + R_3} = \frac{20}{24} + \frac{4}{24} = 1A$$

$$v_2(0^-) = i_2(0^-)R_2 = 11V$$

$i_1(0^-) = 0A \qquad i_2(0^-) = 1A \qquad i_3(0^-) = i_2(0^-) = 1A \qquad i_c(0^-) = 0A$

$i_1(0^+) = \frac{v_s(0^+) - v_C(0^+)}{R_1 + R_2} = 21/15 = 1.4A \quad i_2(0^+) = i_1(0^+) = 1.4A \quad i_3(0^+) = v_C(0^+)/R_3 = 1A \quad i_c(0^+) = i_2(0^+) - i_3(0^+) = 0.4A$

$i_1(\infty) = \frac{v_s(\infty)}{R_1 + R_2 + R_3} = \frac{60}{24} = 1.25A \qquad i_2(\infty) = i_1(\infty) = 1.25A \qquad i_3(\infty) = i_1(\infty) = 1.25A \qquad i_c(\infty) = 0A$

$v_1(0^-) = 0V \qquad v_2(0^-) = 11V \qquad v_C(0^-) = i_3(0^-)R_3 = 9V \qquad v_i(0^-) = v_C(0^-) + v_2(0^-) = 20V$

$v_1(0^+) = i_1(0^+)R_1 = 5.6V \quad v_2(0^+) = i_2(0^+)R_2 = 15.4V \qquad v_C(0^+) = v_C(0^-) = 9V \qquad v_i(0^+) = v_C(0^+) + v_2(0^+) = 24.4V$

$v_1(\infty) = i_1(\infty)R_1 = 5V \qquad v_2(\infty) = i_2(\infty)R_2 = 13.75V \quad v_C(\infty) = i_3(\infty)R_3 = 11.25V \qquad v_i(\infty) = v_C(\infty) + v_2(\infty) = 25V$

$$\tau = R_{eq}C = R_3 \| (R_1 + R_2)C = 56.25 \ \mu s$$

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1.   Fill in the blanks with numbers.

$v_1(0^-) =$ _____ V $v_2(0^-) =$ _____ V $v_L(0^-) =$ _____ V

$v_1(0^+) =$ _____ V $v_2(0^+) =$ _____ V $v_L(0^+) =$ _____ V

$i_1(0^-) =$ _____ A $i_L(0^-) =$ _____ A

$i_1(0^+) =$ _____ A $i_L(0^+) =$ _____ A

$\tau =$ _____ ms

$V_s = 7\text{V}$, $R_1 = 9\Omega$, $R_2 = 20\Omega$, $L = 150$ mH
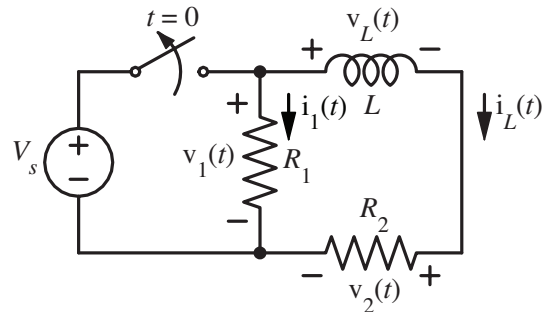
$v_1(0^-) = V_s = 7\text{V}$ $v_2(0^-) = V_s = 7\text{V}$ $v_L(0^-) = 0\text{V}$

$v_1(0^+) = i_1(0^+) \times R_1 = -3.15\text{V}$ $v_2(0^+) = i_L(0^+) \times R_2 = 7\text{V}$ $v_L(0^+) = v_1(0^+) - v_2(0^+) = -10.15\text{V}$

$i_1(0^-) = V_s / R_1 = 7/9 = 0.7778$ A $i_L(0^-) = V_s / R_2 = 7/20 = 0.35$ A

$i_1(0^+) = -i_L(0^+) = -0.35$ A $i_L(0^+) = i_L(0^-) = 0.35$ A

$\tau = L / R_{eq} = 0.15 / 29 = 5.17$ ms

2. Fill in the blanks with numbers.

$i_1(0^-) = $ _____ A $\quad i_2(0^-) = $ _____ A $\quad i_3(0^-) = $ _____ A $\quad i_C(0^-) = $ _____ A

$i_1(0^+) = $ _____ A $\quad i_2(0^+) = $ _____ A $\quad i_3(0^+) = $ _____ A $\quad i_C(0^+) = $ _____ A

$i_1(\infty) = $ _____ A $\quad i_2(\infty) = $ _____ A $\quad i_3(\infty) = $ _____ A $\quad i_C(\infty) = $ _____ A

$v_1(0^-) = $ _____ V $\quad v_2(0^-) = $ _____ V $\quad v_C(0^-) = $ _____ V $\quad v_i(0^-) = $ _____ V

$v_1(0^+) = $ _____ V $\quad v_2(0^+) = $ _____ V $\quad v_C(0^+) = $ _____ V $\quad v_i(0^+) = $ _____ V

$v_1(\infty) = $ _____ V $\quad v_2(\infty) = $ _____ V $\quad v_C(\infty) = $ _____ V $\quad v_i(\infty) = $ _____ V

$\tau = $ _____ μs

$$v_s(t) = 80 + 40\,u(t)\ ,\ i_s(t) = 4\,u(-t)\ ,\ R_1 = 4\Omega$$
$$R_2 = 11\Omega\ ,\ R_3 = 9\Omega\ ,\ C = 10\mu F$$
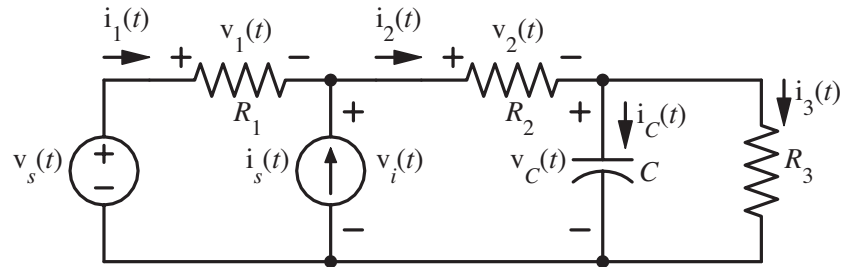
$$i_1(0^-) = \frac{v_s(0^-)}{R_1 + R_2 + R_3} - i_s(0^-)\frac{R_2 + R_3}{R_1 + R_2 + R_3} = \frac{80}{24} - 4\frac{20}{24} = 0$$
$$v_1(0^-) = i_1(0^-)R_1 = 0V$$
$$i_2(0^-) = \frac{v_s(0^-)}{R_1 + R_2 + R_3} + i_s(0^-)\frac{R_1}{R_1 + R_2 + R_3} = \frac{80}{24} + 4\frac{4}{24} = 4A$$
$$v_2(0^-) = i_2(0^-)R_2 = 44V$$

$\quad i_1(0^-) = 0A \qquad\qquad i_2(0^-) = 4A \qquad i_3(0^-) = i_2(0^-) = 4A \qquad\qquad i_C(0^-) = 0A$

$i_1(0^+) = \dfrac{v_s(0^+) - v_C(0^+)}{R_1 + R_2} = 84/15 = 5.6A \quad i_2(0^+) = i_1(0^+) = 5.6A \quad i_3(0^+) = v_C(0^+)/R_3 = 4A \quad i_C(0^+) = i_2(0^+) - i_3(0^+) = 1.6A$

$\quad i_1(\infty) = \dfrac{v_s(\infty)}{R_1 + R_2 + R_3} = \dfrac{60}{24} = 5A \qquad i_2(\infty) = i_1(\infty) = 5A \qquad i_3(\infty) = i_1(\infty) = 5A \qquad\qquad i_C(\infty) = 0A$

$\quad v_1(0^-) = 0V \qquad\qquad v_2(0^-) = 44V \qquad v_C(0^-) = i_3(0^-)R_3 = 36V \quad v_i(0^-) = v_C(0^-) + v_2(0^-) = 80V$

$v_1(0^+) = i_1(0^+)R_1 = 22.4V \quad v_2(0^+) = i_2(0^+)R_2 = 61.6V \quad v_C(0^+) = v_C(0^-) = 36V \quad v_i(0^+) = v_C(0^+) + v_2(0^+) = 97.6V$

$\quad v_1(\infty) = i_1(\infty)R_1 = 20V \qquad v_2(\infty) = i_2(\infty)R_2 = 55V \qquad v_C(\infty) = i_3(\infty)R_3 = 45V \qquad v_i(\infty) = v_C(\infty) + v_2(\infty) = 100V$

$$\tau = R_{eq}C = R_3 \,\|\, (R_1 + R_2)C = 56.25\ \mu s$$