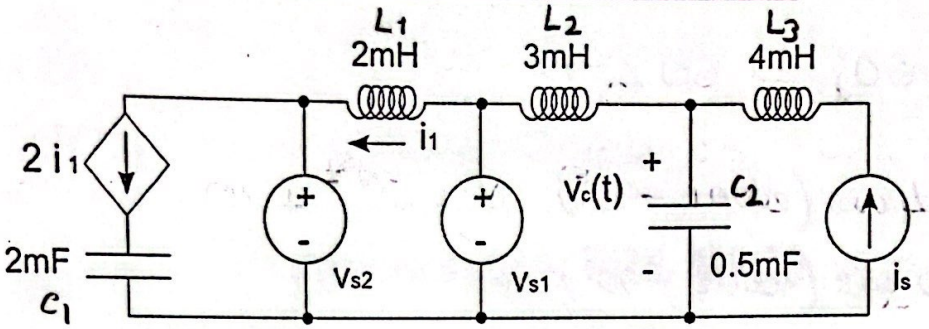
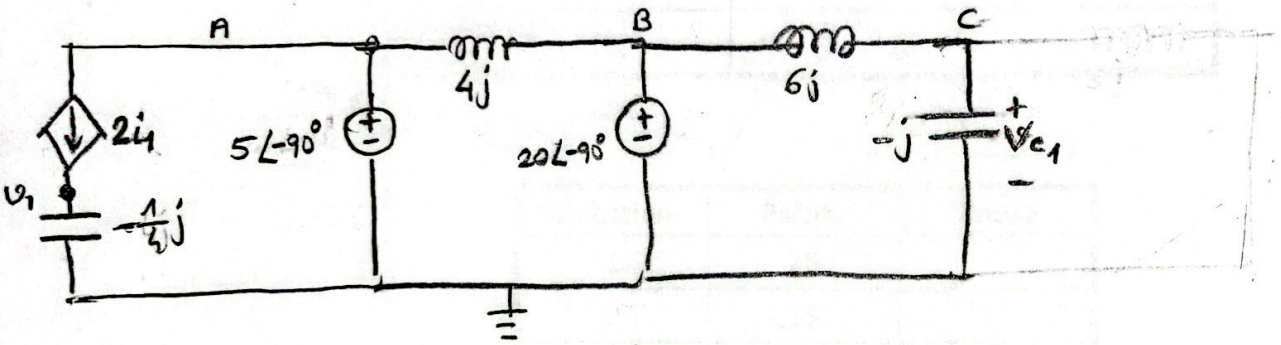
Question 4 (25 pts)

Find $v_c(t)$ at steady-state for $i_s(t) = 10cos(1000t)\ A$, $v_{s1}(t) = 20cos(2000t - 90°)\ V$, and $v_{s2}(t) = 5cos(2000t - 90°)\ V$. **Clearly show all your work and derivations.**



Kill i_s: $w = 2000$, $\frac{1}{jwC_1} = \frac{1}{j \cdot 2000 \cdot 2 \cdot 10^{-3}} = \frac{1}{4j}$, $\frac{1}{jwC_2} = \frac{1}{j \cdot 2 \cdot 10^3 \cdot 5 \cdot 10^{-4}} = -j$

$jwL_1 = j \cdot 2 \cdot 10^3 \cdot 2 \cdot 10^{-3} = 4j$, $jwL_2 = j \cdot 2 \cdot 10^3 \cdot 3 \cdot 10^{-3} = 6j$, $jwL_3 = 8j$

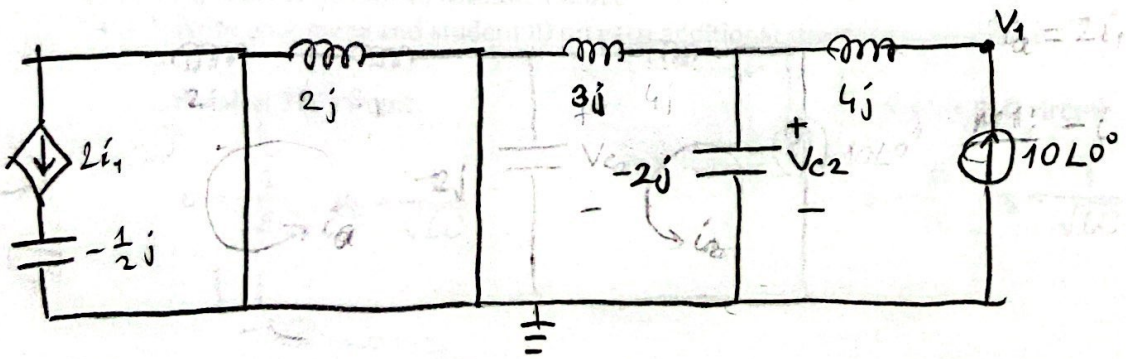


KCL C: $\frac{V_{c1} - 20\angle -90°}{6j} + \frac{V_{c1}}{-j} = 0$

$\Rightarrow -5V_{c1} = 20\angle -90° \Rightarrow V_{c1} = -4\angle -90°$

Kill v_{s1} and v_{s2}: $w = 1000$, $\frac{1}{jwC_1} = \frac{1}{j \cdot 10^3 \cdot 2 \cdot 10^{-3}} = -\frac{1}{2}j$, $\frac{1}{jwC_2} = -2j$

$jwL_1 = 2j$, $jwL_2 = 3j$, $jwL_3 = 4j$



KCL V_1: $\frac{V_1 - V_{c2}}{4j} = 10\angle 0° \Rightarrow V_1 = 40j + V_{c2}$