Electronic Circuits: Final Examination

2004/1/16

1. **(15%)** For the circuit shown in Fig. Q1, find i_1, i_2, and v_a.

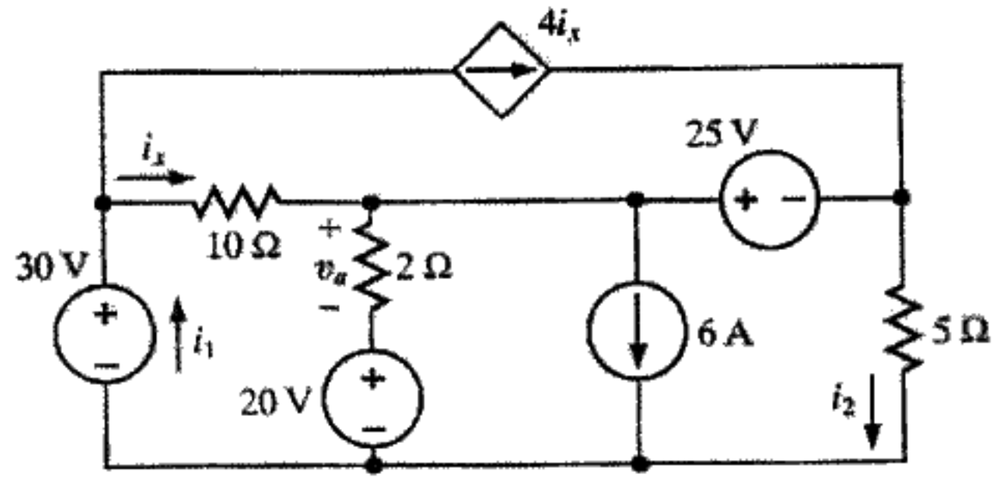

Fig. Q1

2. **(10%)** In the circuit shown in Fig. Q2, both op-amps are ideal. Find v_b / v_{in} and $R_{in} = v_{in} / i_{in}$.

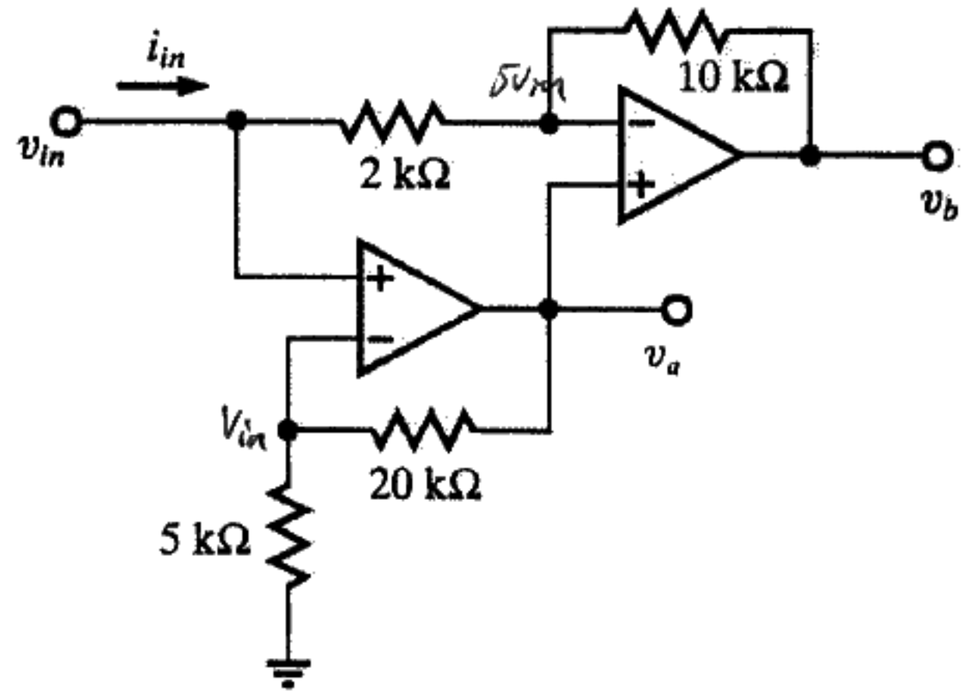

Fig. Q2

3. The circuit in Fig. Q3 is a phase shift network, where $Z_a = 1/\, j\omega C$ and $Z_b = R$.
   (a) **(8%)** Find $H(j\omega) = \underline{V}_x / \underline{V}$ by assuming $\underline{I}_4 = 1A\angle 0°$.
   (b) **(7%)** Determine the oscillating frequency ω_{osc}, at which $\angle \underline{V}_x / \underline{V} = -180°$.

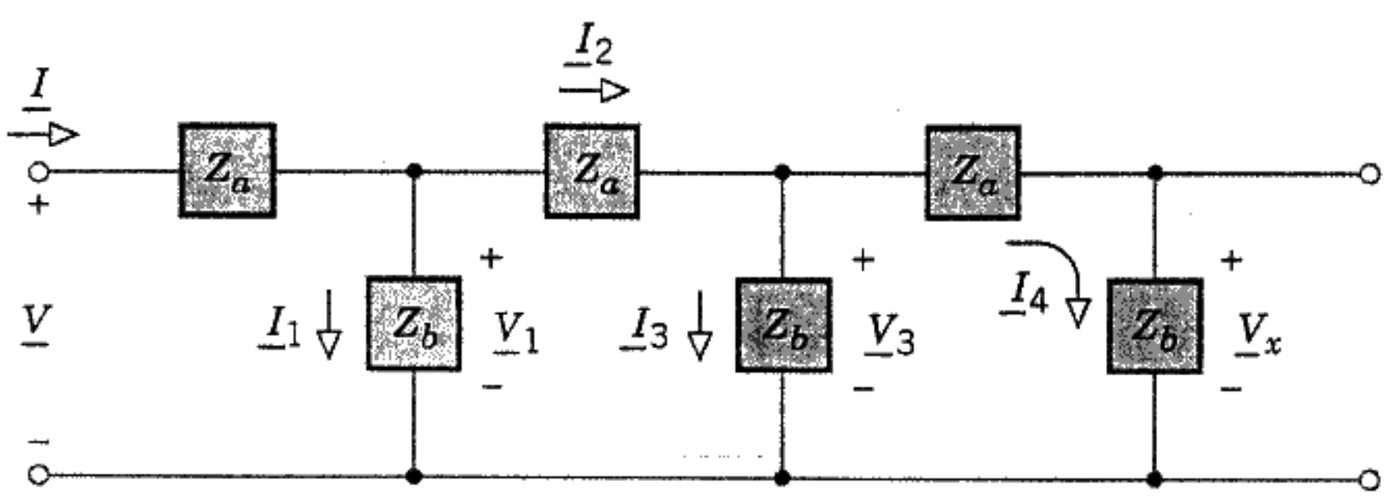

Fig. Q3

4. **(10%)** Given a transfer function $H(s)=\dfrac{20}{s^2+4s+20}$, find the step response.

5. **(20%)** Find $i_L(t)$ for $t>0$ in Fig. Q5 when

$$v_s(t)=\begin{cases}-5V & t<0\\ 10V & t>0\end{cases}$$

Let $L=2\text{H}$, $R=5\Omega$, and $C=1/50$ F.

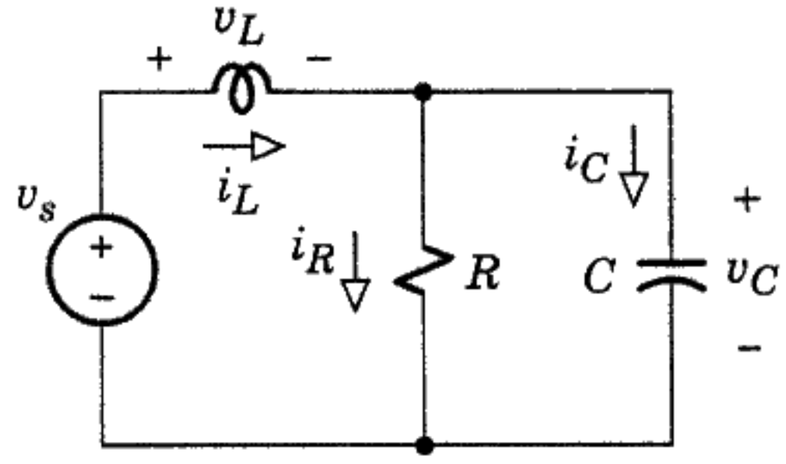

Fig. Q5

6. **(15%)** Construct the asymptotic Bode plot of the gain and phase for

$$H(s)=\frac{8s^2}{(s+50)(s+500)}$$

7. **(15%)** Let the circuit in Fig. Q7 have $v_s(t)=\begin{cases}5V & t<0\\ (\sin t)V & t>0\end{cases}$

Find $V_C(s)$, $v_C(0^+)$, and $v_C'(0^+)$.

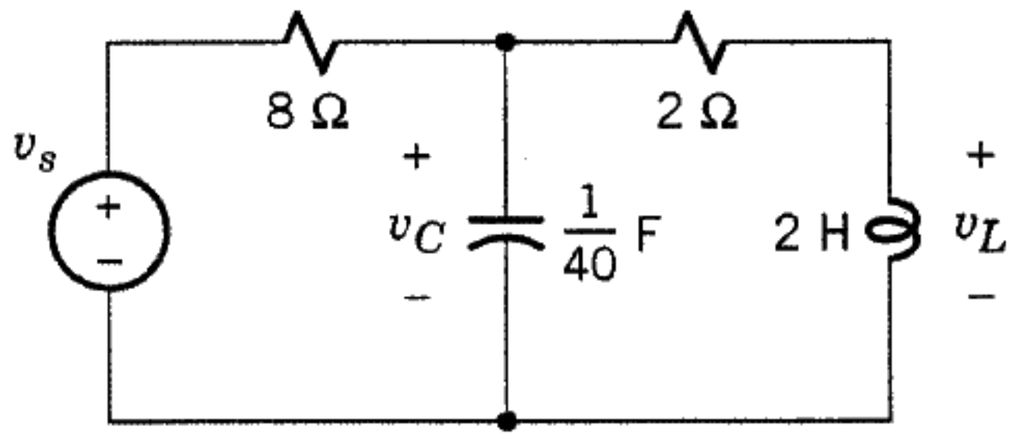

Fig. Q7