SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

ENSC 220
ELECTRIC CIRCUITS I

Final Examination
December 17, 1998

Attempt all four problems. Problems are equally weighted.

1. The circuit shown in Fig. 1 is an equivalent circuit of a transistor amplifier. If $R_s = 8\Omega$, $R_1 = 1\Omega$, $R_2 = 5\Omega$, and $R_f = 30\Omega$:
   - Determine the voltage gain $G = v_2/v_s$ as a function of β.
   - Describe how G varies with β.
   - If $\beta = 50$ and R_s, R_1, and R_2 are as given, determine the feedback resistance R_f so that the voltage gain $G = 5$.
2. The circuit shown in Fig. 2 has an ideal op-amp.
   - Obtain the differential equations for $v_o(t)$ by writing nodal analysis equations.
   - If $v_i(t) = 6u(t)$ and $v_C(0_-) = 4V$, find $v_o(t)$ for $t > 0$.
   - What would be an appropriate name for this circuit?
3. For the circuit shown in Fig. 3:
   - Write the state equations.
   - Find the natural frequencies of the system.
   - How would you classify the system: over-damped, under-damped, or critically damped?
4. In the circuit shown in Fig. 4 the current source is a periodic sinusoidal function with the radian frequency $\omega = 10$ rad/sec. The circuit operates in the steady-state regime.
   - Find the Thévenin's equivalent circuit between the terminals $A - B$.
   - Represent the Thévenin's impedance first as a parallel and then as a series connection of two circuit elements.

Fig. 1

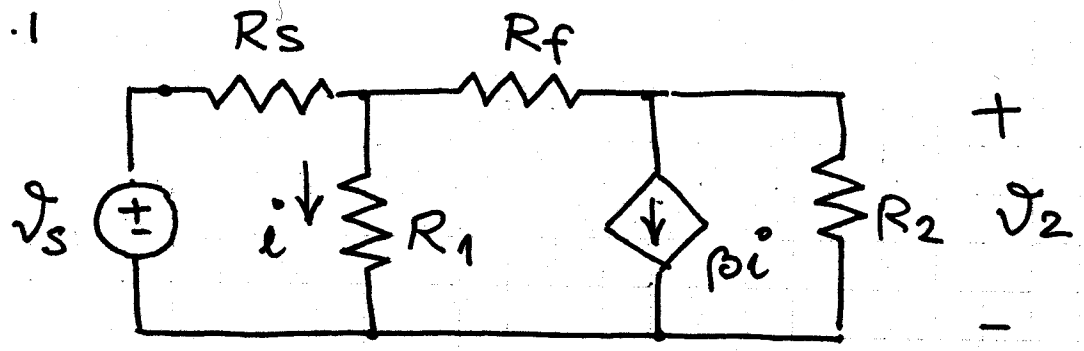


Fig. 2

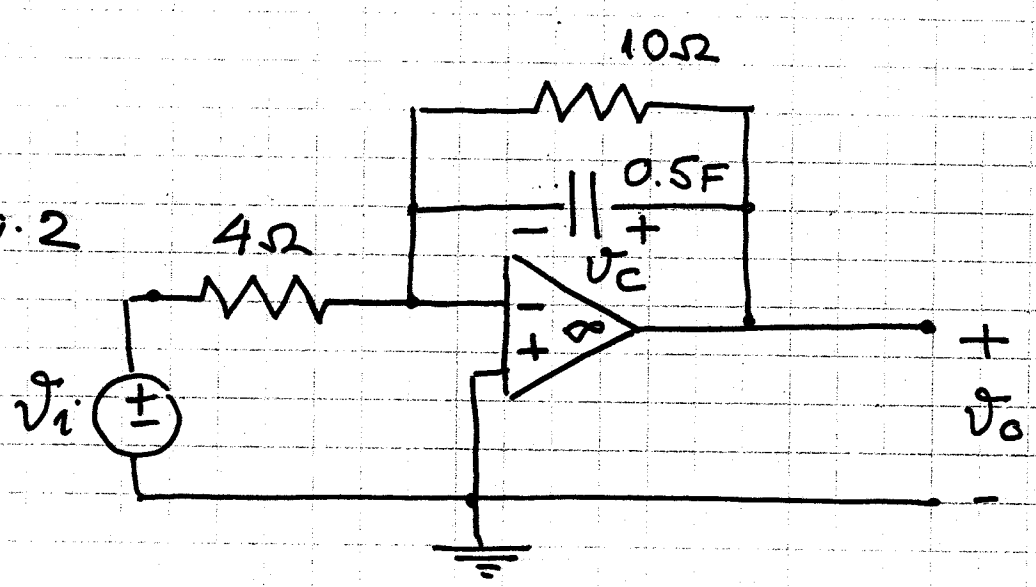


Fig. 3

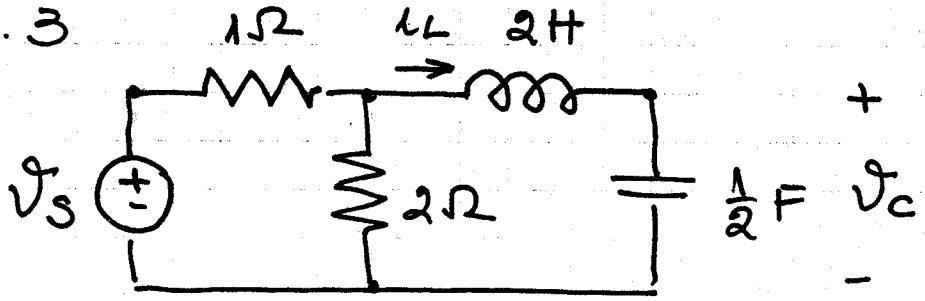
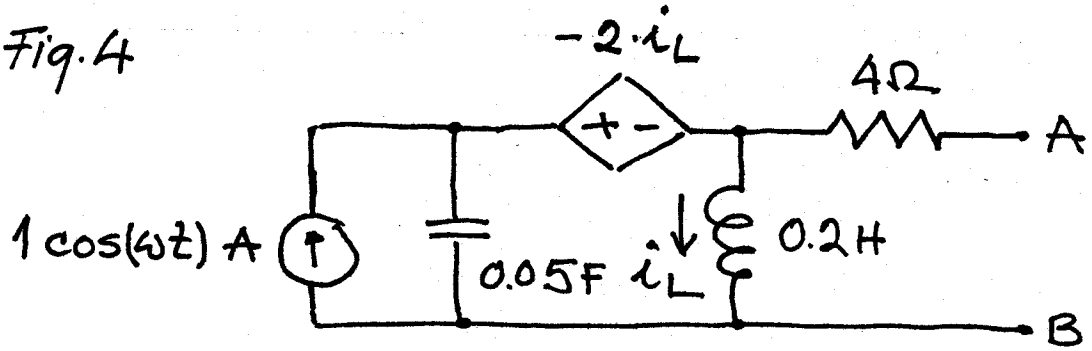


Fig. 4



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