EEEN 202 Electrical and Electronic Circuits II
Homework 01

Due: 15-March-2019
Friday 17:00

Problem 1)

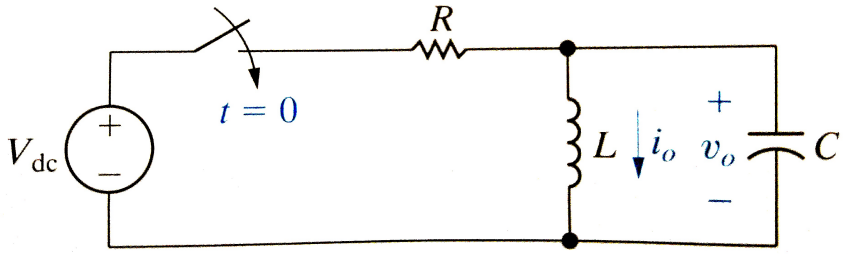

Figure P1

The switch in Figure P1 has been open for a long time. At $t = 0$, the switch is closed.

a) Derive the integro-differential equation that governs the behavior of the voltage v_0 for $t \geq 0$.

b) Show that

$$V_o(s) = \frac{\frac{V_{dc}}{RC}}{s^2 + \left(\frac{1}{RC}\right)s + \left(\frac{1}{LC}\right)}$$

c) Show that

$$I_o(s) = \frac{\frac{V_{dc}}{RLC}}{s\left[s^2 + \left(\frac{1}{RC}\right)s + \left(\frac{1}{LC}\right)\right]}$$

Problem 2)

Find $f(t)$ for each of the following equations.

a)

$$F(s) = \frac{10s^2 + 512s + 7186}{s^2 + 48s + 625}$$

b)

$$F(s) = \frac{(s+5)^2}{s(s+1)^2}$$

c)

$$F(s) = \frac{s^3 + 5s^2 - 50s - 100}{s^2 + 13s + 40}$$

Problem 3)

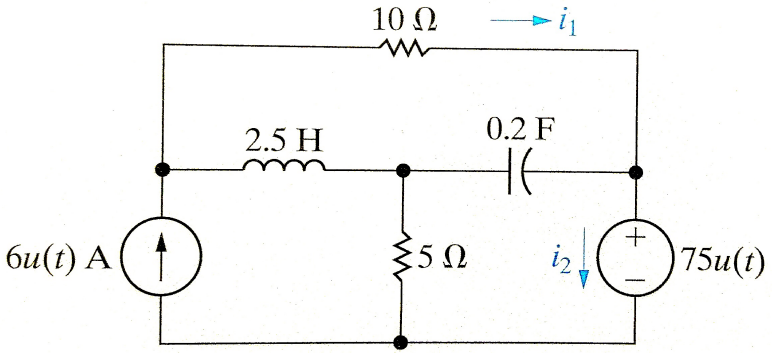

Figure P3

There is no energy stored in the Figure P4. At the time sources are energized;

- **a)** Find $I_1(s)$ and $I_2(s)$.
- **b)** Use the initial-value and final-value theorems to check the initial values of $i_1(t)$ and $i_2(t)$.
- **c)** Find $i_1(t)$ and $i_2(t)$ for $t > 0$.

Problem 4)

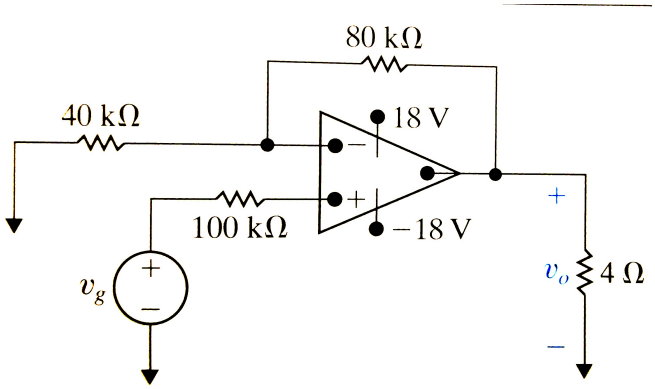

Figure P4

The op amp in the noninverting amplifier circuit of Fig. P4 has an input resistance of $500k\Omega$, an output resistance of $1k\Omega$, and an open loop gain of $10{,}000$. Assume that the op amp is operating in the linear region.

- **a)** Calculate the voltage gain (v_0/v_g).
- **b)** Find the inverting and non-inverting input voltages v_n and v_p (in millivolts) if $v_g = 1V$.
- **c)** Calculate the difference $(v_p - v_n)$ in microvolts when $v_g = 1V$.
- **d)** Find the current drain in picoamperes on the signal source v_g when $v_g = 1V$.
- **e)** Repeat (a)-(d) assuming ideal op-amp