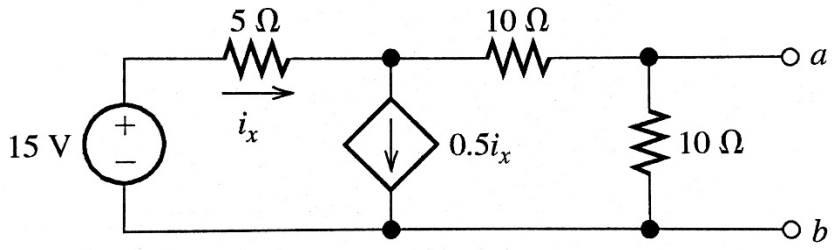
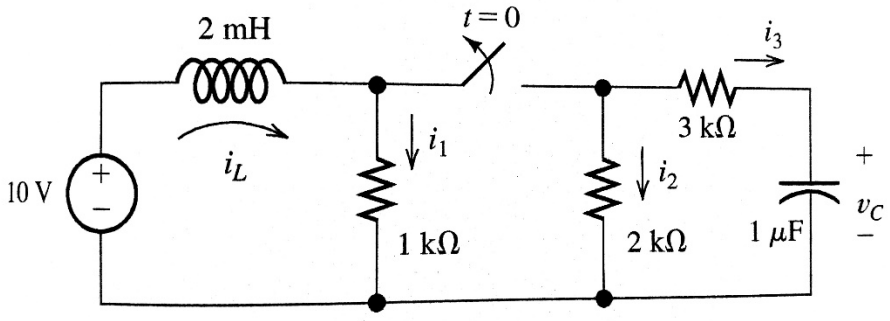
ECE100 Practice Final

Q1: Find Thevenin and Norton equivalent circuits for the circuit shown below.



Q2: Consider the circuit shown below. The circuit has been operating for a long time with the switch closed prior to $t = 0$.

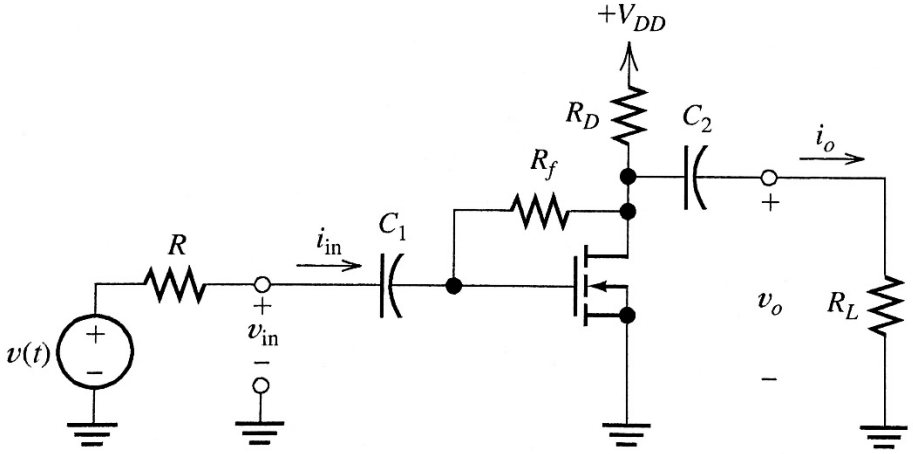
a. Determine the values of i_L, i_1, i_2, i_3, and v_C just before the switch opens.
b. Determine the values of i_L, i_1, i_2, i_3, and v_C immediately after the switch opens.
c. Find $i_L(t)$ for $t > 0$.
d. Find $v_C(t)$ for $t > 0$.



Q3: Draw a CMOS logic circuit for a 2-input AND gate using NMOS and PMOS transistors.

Q4: Consider the amplifier shown below.

a. Draw the small signal equivalent circuit assuming that the capacitors are short circuits for the signal.
b. Assume that $r_d = \infty$ and derive an expression for the voltage gain.
c. Find I_{DQ} if $R = 100k\Omega$, $R_f = 100k\Omega$, $R_D = 3k\Omega$, $R_L = 10k\Omega$, $V_{DD} = 20V$, $V_{t0} = 5V$, and $K = 1mA/V^2$. Determine the value of g_m at the Q point.
d. Evaluate the expression from part b using the values in part c.
e. Is this amplifier inverting or noninverting?



Q5: Consider the bridge amplifier shown below.

a. Assuming ideal op amps, derive an expression for the voltage gain v_o/v_s
b. If $v_s(t) = 3\sin(\omega t)$, sketch $v_1(t)$, $v_2(t)$, and $v_o(t)$ to scale versus time.
c. If the op amps are supplied from $\pm 15V$ and clip at output voltages of $\pm 14V$, what is the peak value of $v_o(t)$ just at the threshold of clipping? (Note: This circuit can be useful if a peak output voltage greater than the magnitude of the supply voltages is required.)