ECE110 **Midterm Exam** **Spring 2020**

Name: _____

UID: _____

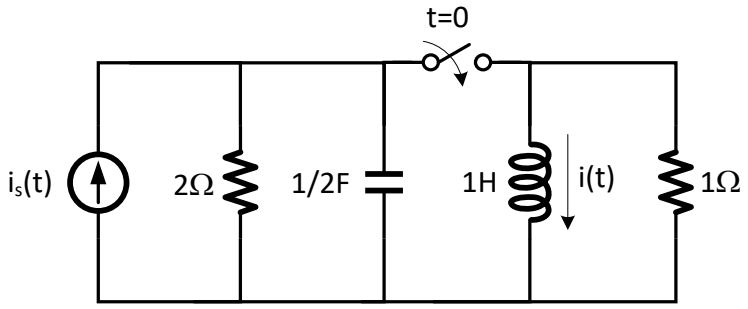
Total of 2 questions, 120 minutes (including scan/upload).

P1 (40)	
P2 (60)	
Total (100)	

1. The circuit shown is in the steady state with switch open. The switch closes at $t = 0$. $i_s(t) = \delta(t)$.

a. Find the inductor current $i(t)$ for $t \geq 0$ by directly solving the time-domain differential equation.

b. Redo part a using Laplace transform.



2. In the linear time-invariant circuit shown below, $g_m = 1\text{S}$, $v_C(0^-) = 1V$, and $i_L(0^-) = -1A$. Assume $i_s(t)$ is bounded, and is enforced at $t = 0$.
   a. Using node voltage analysis, write the integro-differential equations of the circuit. You do not need to solve them.
   b. Indicate the necessary initial conditions for $v_C(t)$ ($v_C(0^-)$ and $\frac{d}{dt}v_C(0^-)$).
   c. If the circuit is in sinusoidal steady state, with $i_s(t) = (2cost)u(t)$, find the capacitor voltage, $v_C(t)$.