Instructions: This is an open-book, open-notes exam. Laptops may be used for access to reference material only. You have exactly 50 minutes to complete the exam. Be as neat as possible. Use the space provided and attach additional sheets as necessary (provided by proctor).

1. For the circuit shown below, assuming the normally-closed switch opens at $t = 0^-$, derive the initial conditions, transform the circuit to the Laplace domain, and solve for the output $Y(s)$ in terms of $R$, $L$, and $C$.

![Circuit diagram](image)

2. For a system whose transfer function is given by

$$H(s) = \frac{1}{s^2 + 3s + 2}$$

determine the zero-state response for $x(t) = e^{-4t}u(t)$.

3. For a system whose impulse response is

$$h(t) = e^{-t}u(t)$$

Determine the zero-state response for $x(t) = u(t) - u(t - 1)$ using Laplace.

4. For the following transfer function

$$H(s) = \frac{3}{2s + 1}$$

realize the transfer function in Direct Form I using integrators.

5. For the following transfer function

$$H(s) = \frac{1}{s + 2}$$

Determine the magnitude and phase of the frequency response, and the steady state output due to an input $x(t) = 3\cos(2t + 2)$.